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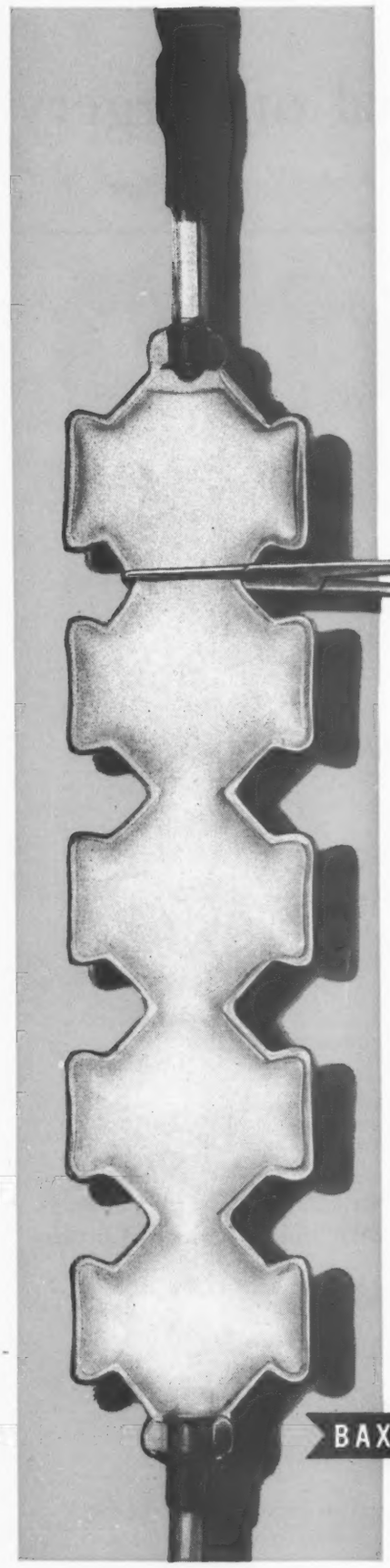

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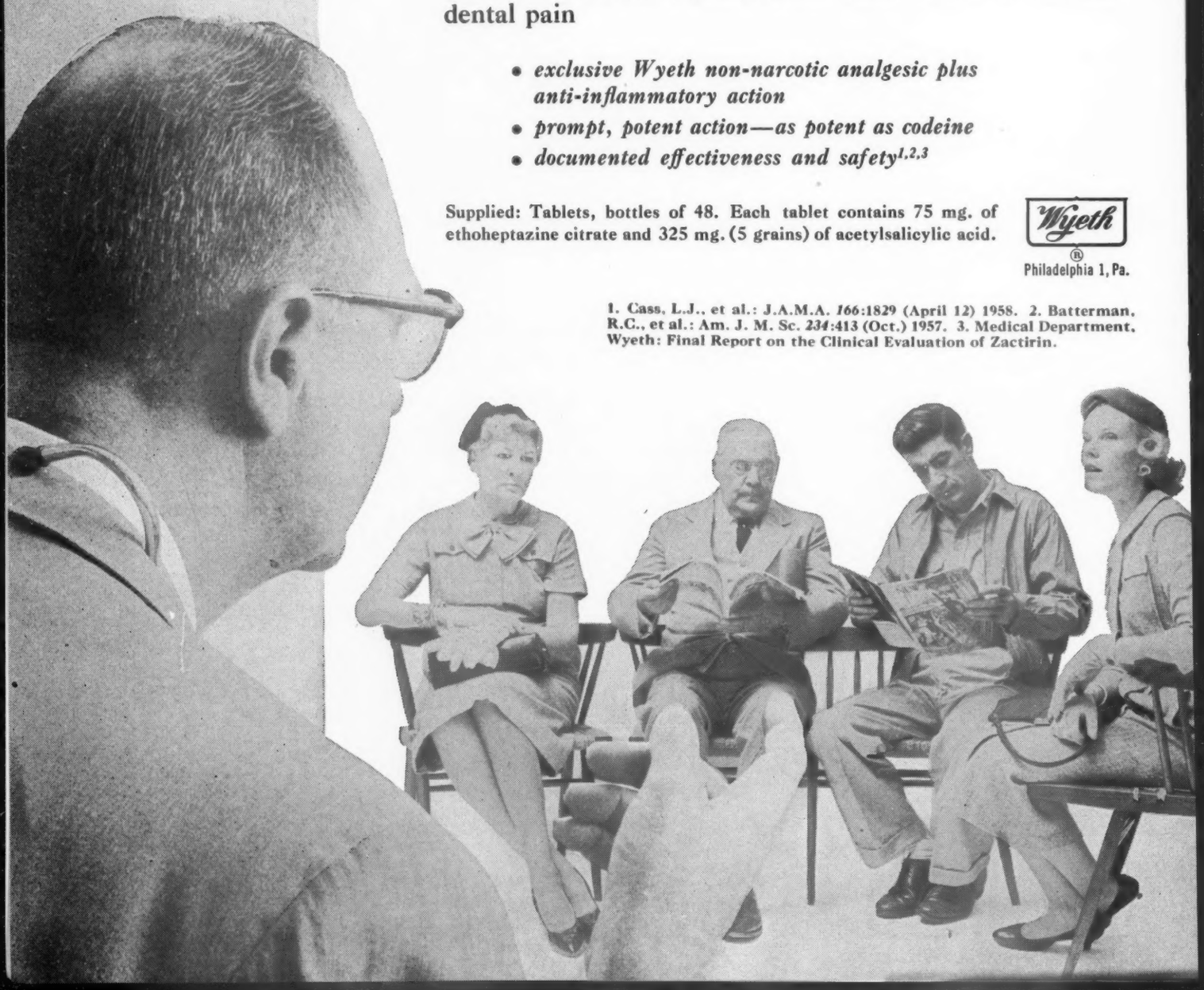

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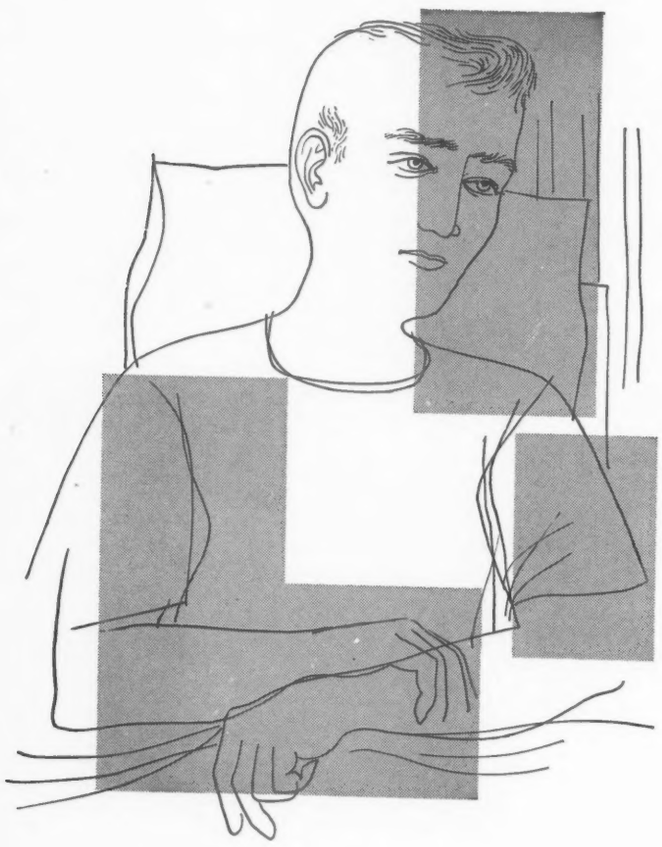

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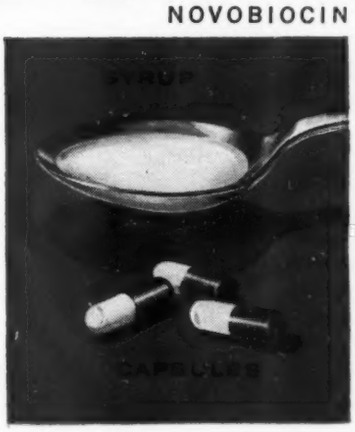

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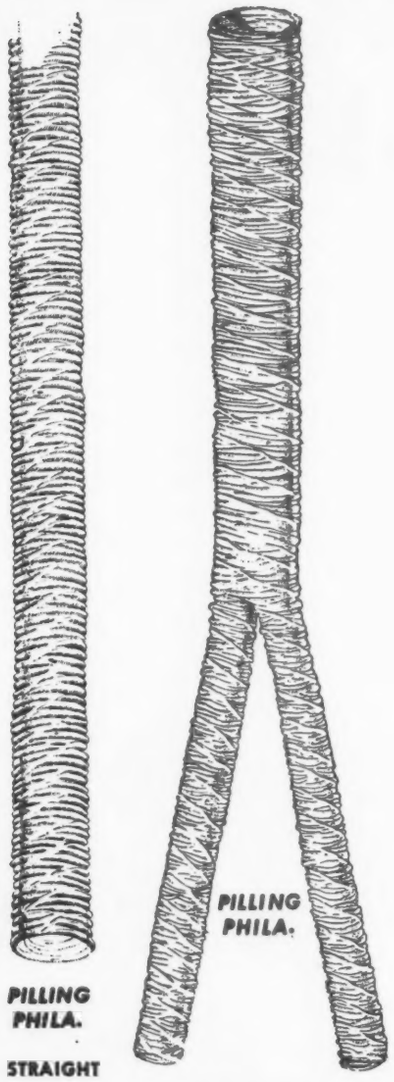

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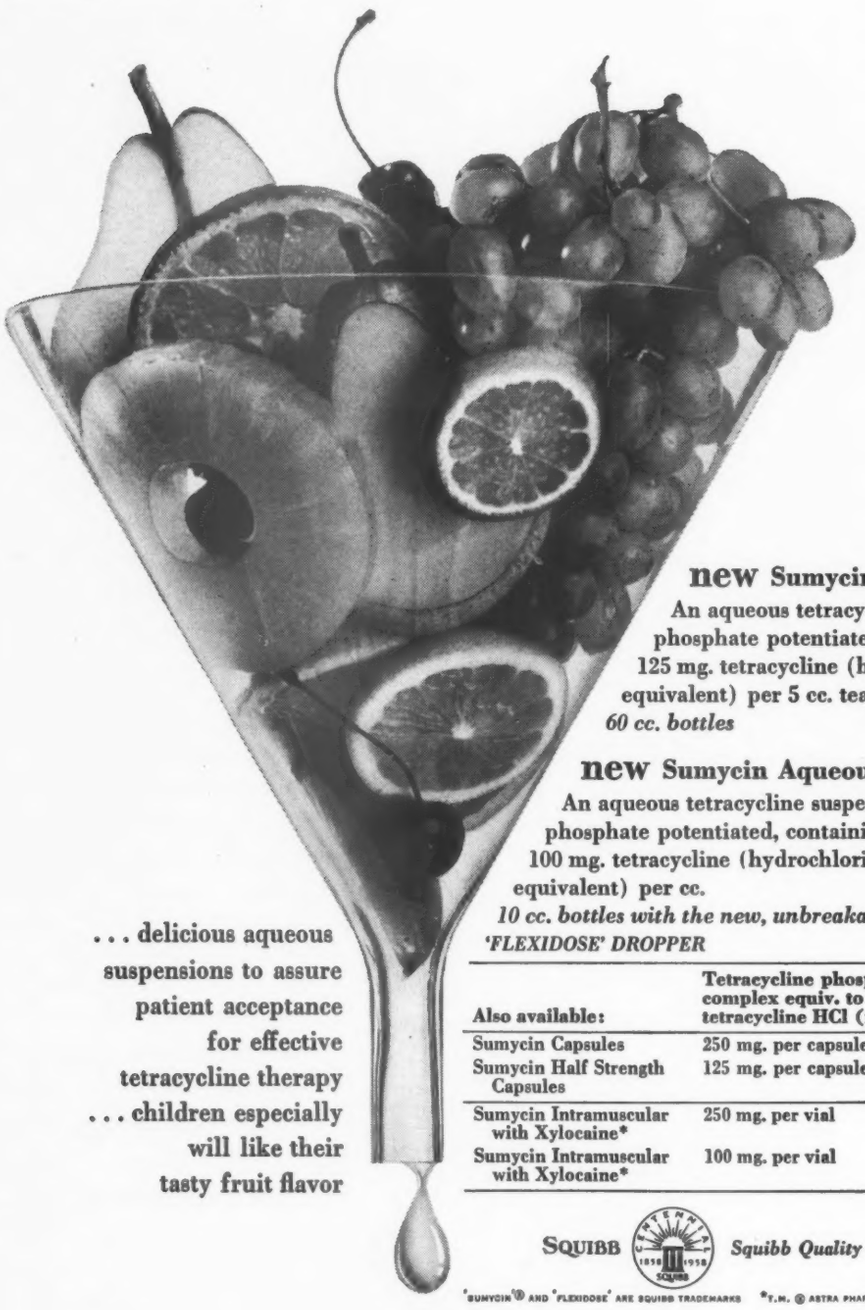

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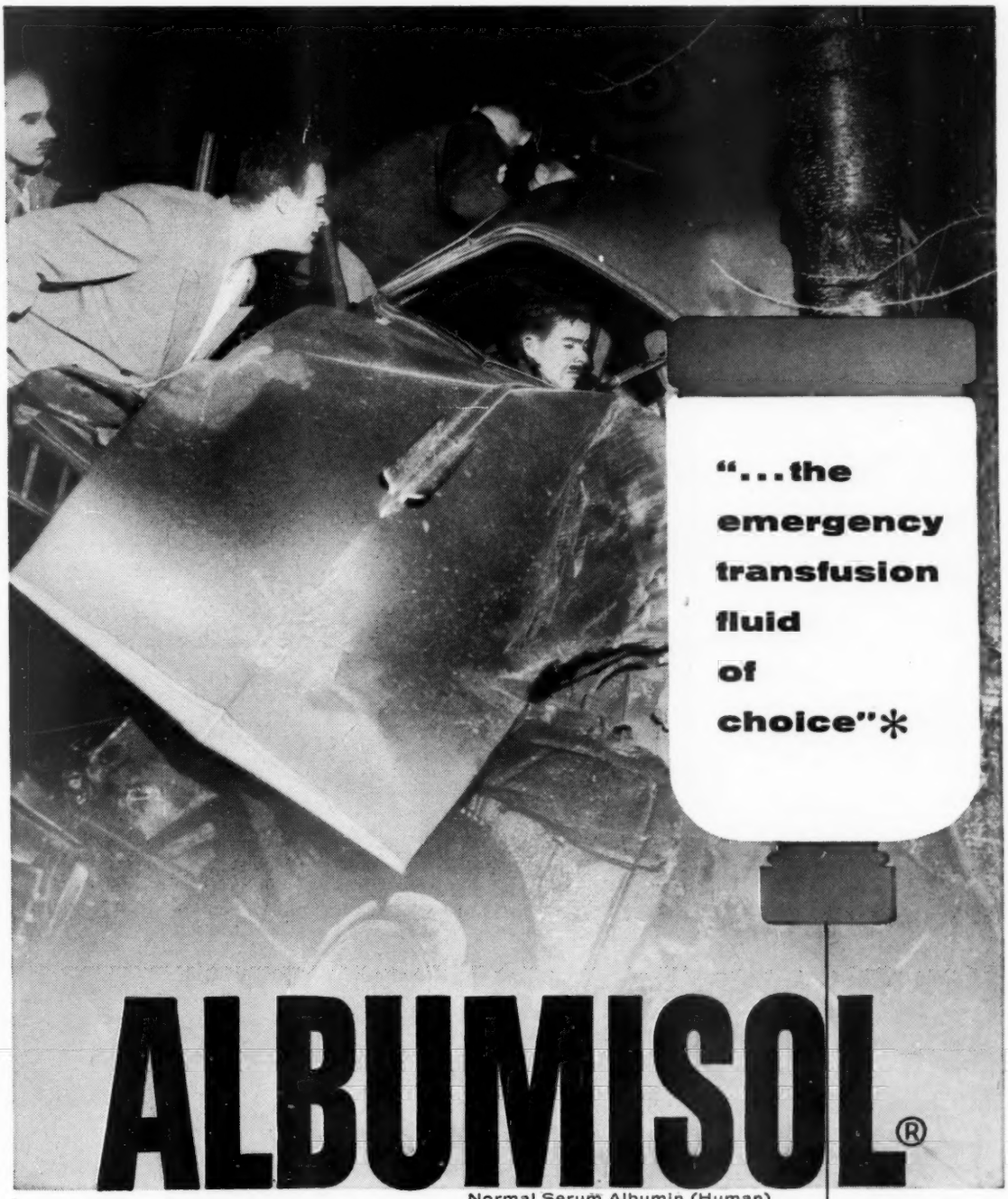

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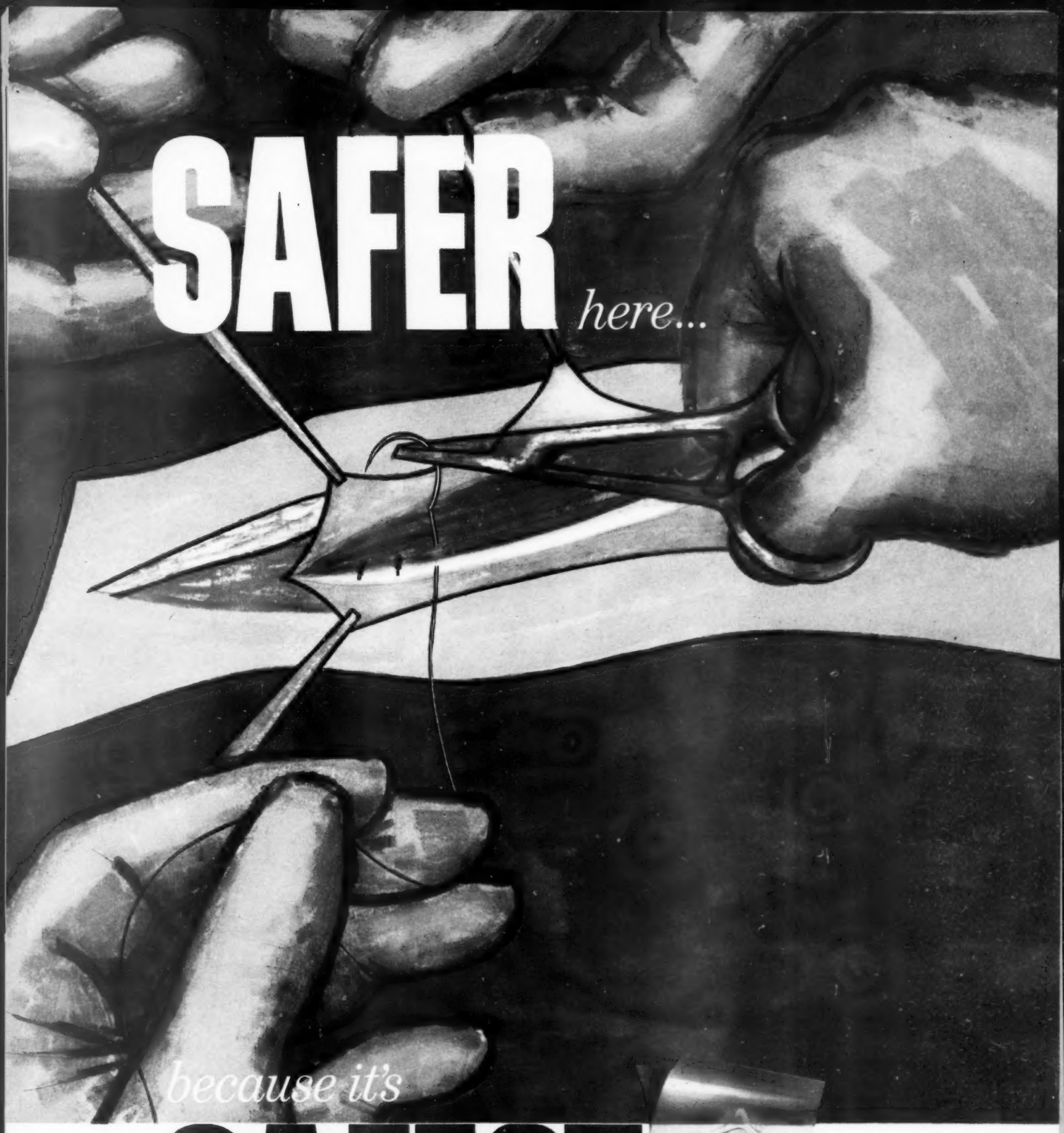

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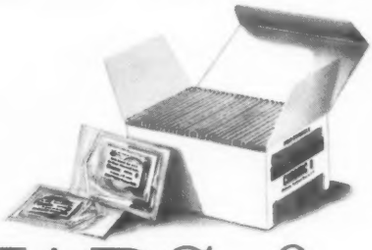

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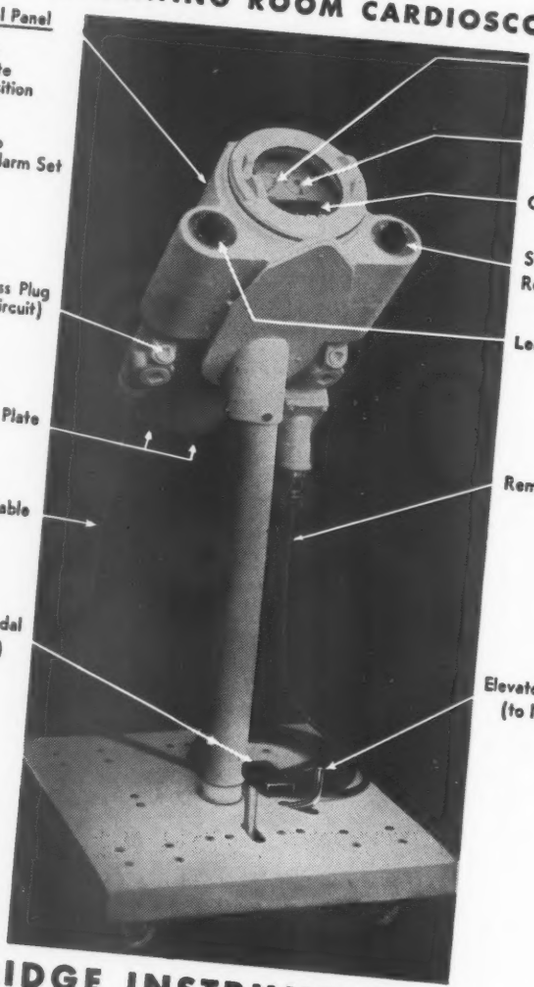

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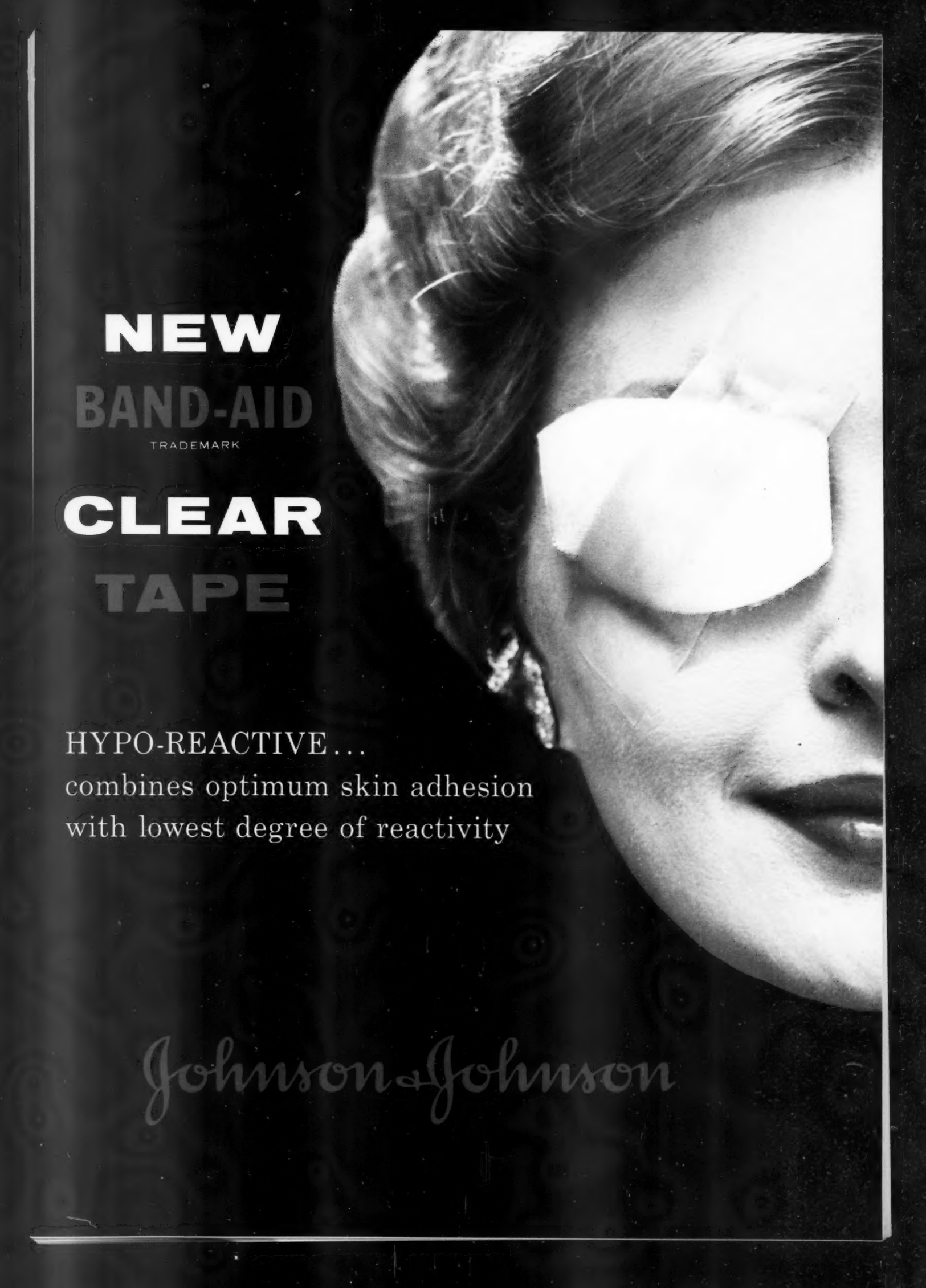
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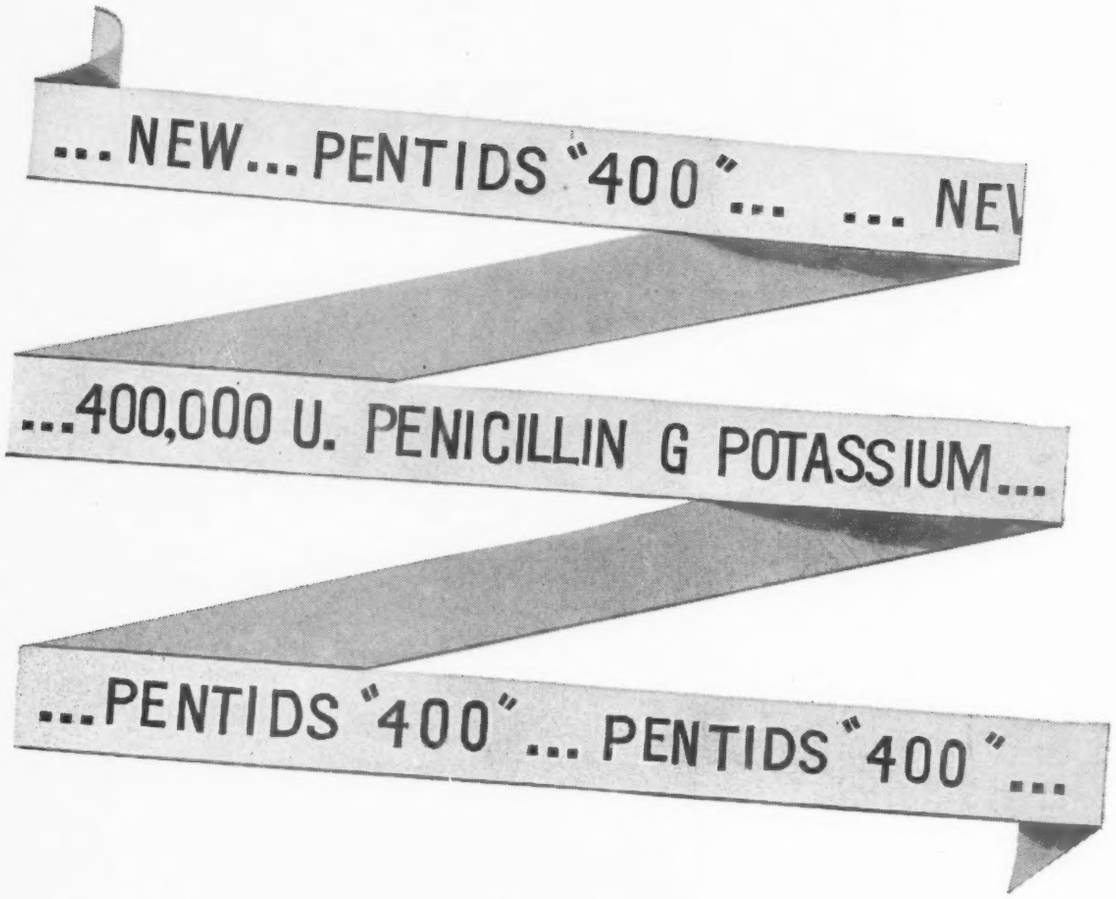

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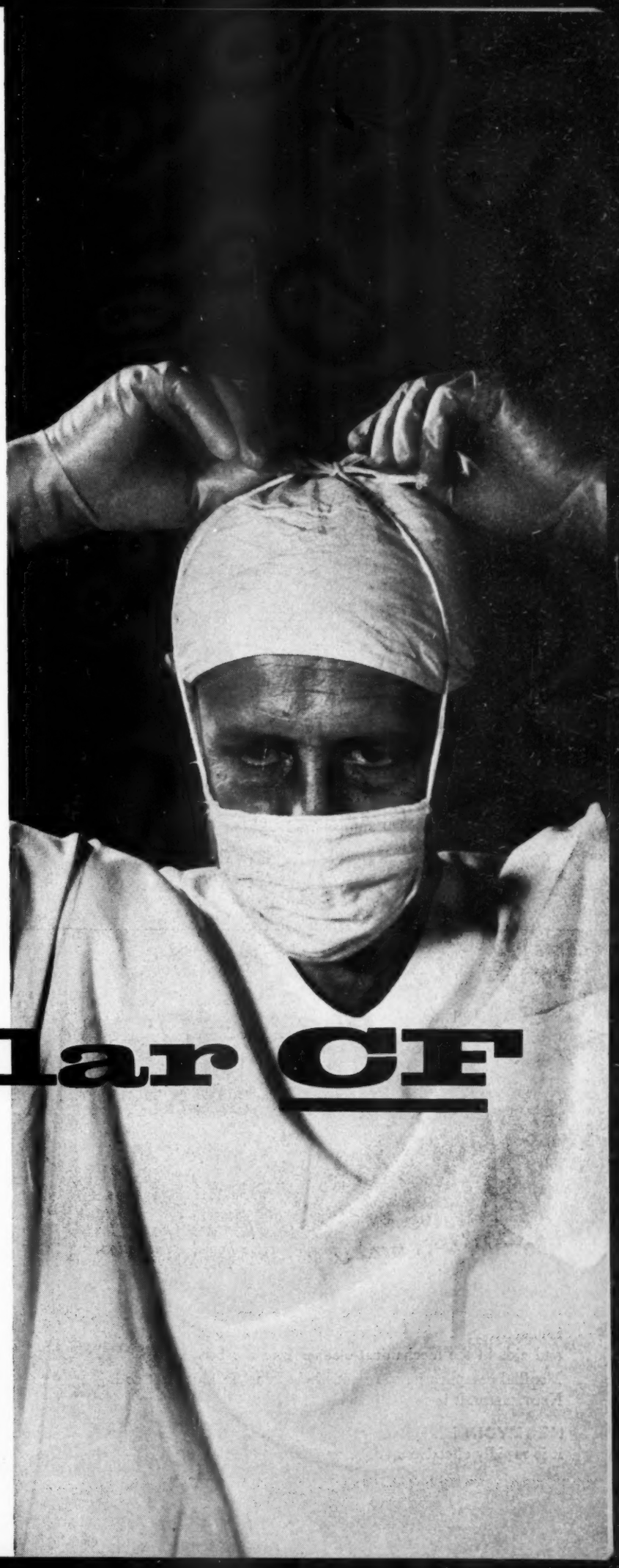

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*L. O. Randall and J. Selitto, *J. Am. Pharm. Assn. (Sc. Ed.)*, 47:313, 1958.

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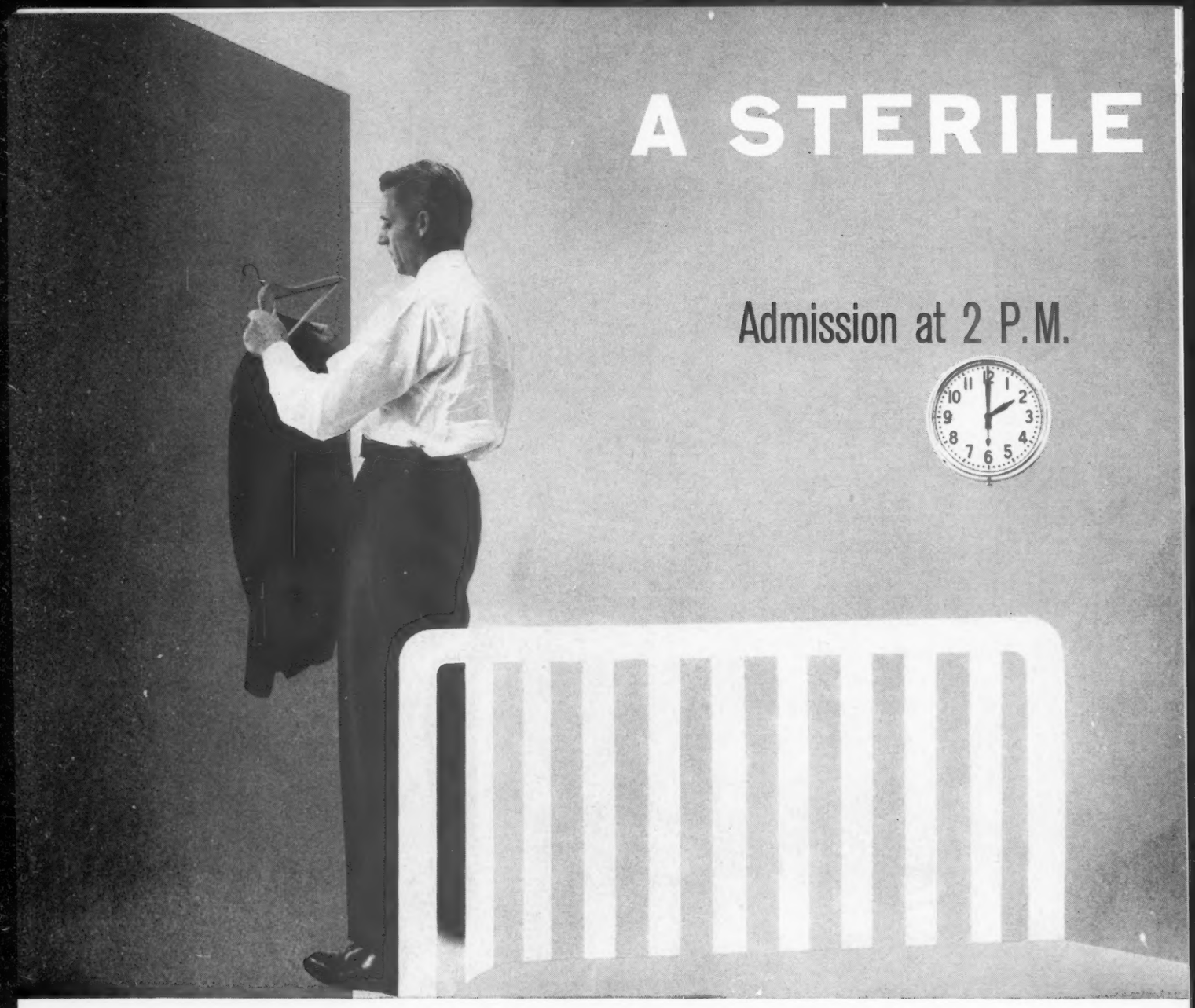

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1. Poth, E. J.: Intestinal Antisepsis in Surgery, J.A.M.A. 153:1516, Dec. 26, 1953.

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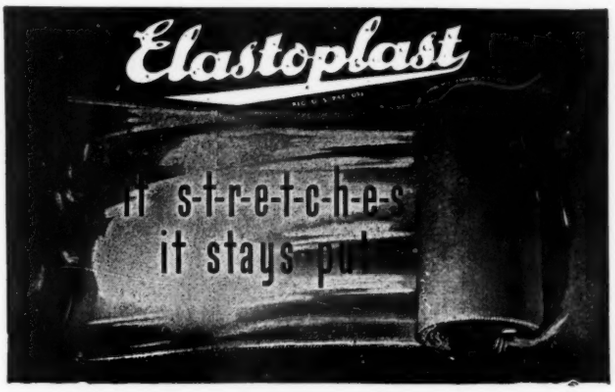

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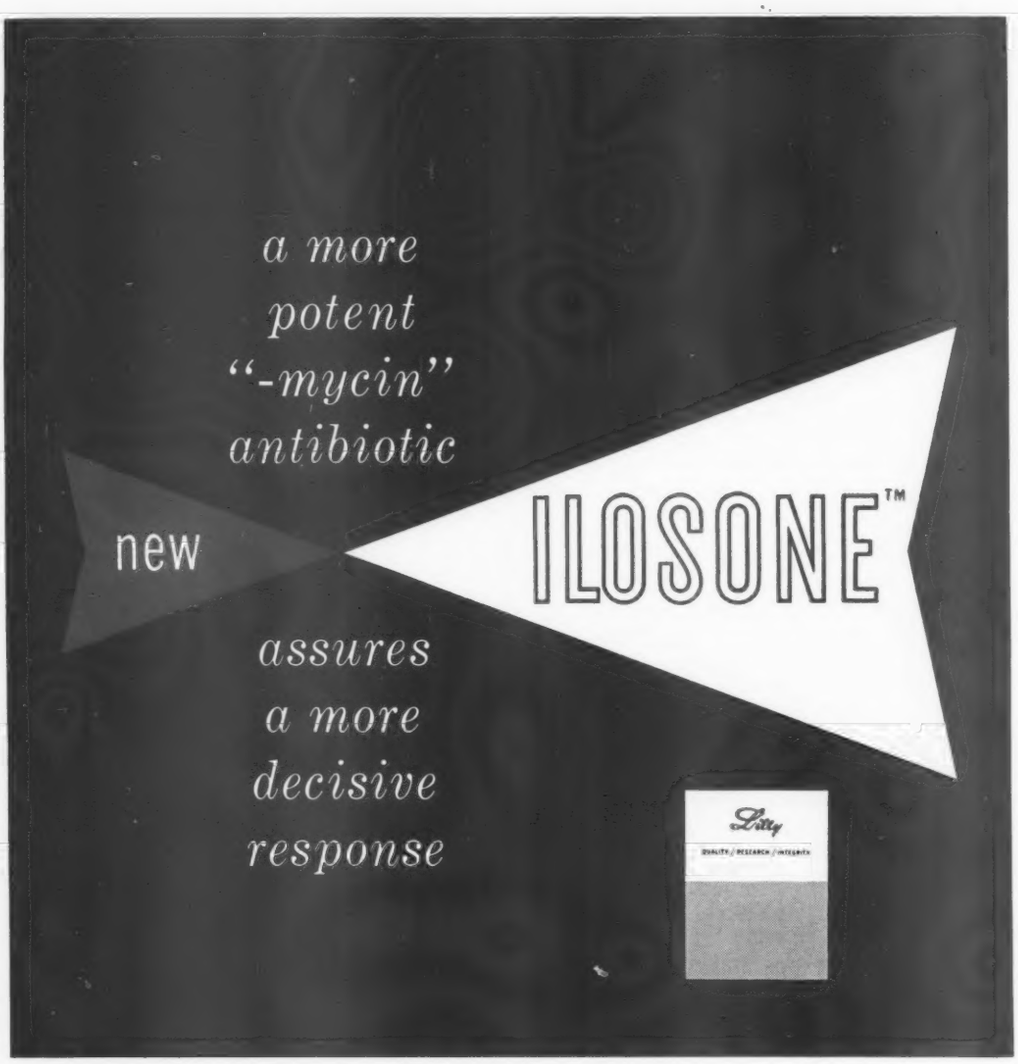

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The American Journal of Surgery

VOLUME 96 DECEMBER 1958 NUMBER SIX

SYMPOSIUM ON MAXILLOFACIAL SURGERY

Controlled Correction of Diplopia and Eye Muscle Imbalance in Orbital and Zygomatic Fractures

RUDOLPH H. PELZER, M.D., D.D.S. AND WILLIAM J. GARVIN, M.D., *Yonkers, New York*

From the Departments of Plastic and Maxillofacial Surgery, and Opbthalmology, St. John's Riverside Hospital, Yonkers, New York.

THERE has been an ever increasing incidence of facial trauma throughout the country, to a large extent due to the increase in automobile accidents. This facial trauma has broadened the experience of all maxillofacial surgeons since the wide range of soft tissue injuries and fractures may occur with varying combinations and severity. In some instances the difficulty in treatment is further compounded because of associated injury to the brain and eyes, or to other parts of the body.

Fractures of the zygoma and zygomatic compound are so commonplace that many methods of treatment have evolved over the years, and they have found adherents dependent chiefly on familiarity with the method and the particular skill of the individual surgeon. Perhaps other criteria for a choice of method could be added including surgical simplicity, avoidance of injury to the patient and avoidance of further evident scarring. When a large number of procedures are available for a given purpose, it is likely that they each have some advantages as well as shortcomings.

Diplopia and enophthalmos are frequent complications of fractures involving the orbital bones. These eye changes ordinarily occur with depressed fractures of the zygomatic compound but may, in rare instances, result from fractures of the orbital bones alone, without fracture of the zygoma or orbital border. The mechanism of this type of fracture has been demonstrated experimentally and has been described as a "blow-out" fracture of the orbit [1]. When the diagnosis is made clinically, reduction and fixation of the orbital floor retains the inherent difficulty of determining the level of the orbital floor reduction for correction of the visual dysfunction. The same difficulty is inherent in the reduction of the orbital floor fracture for diplopia when the zygomatic compound also is involved. The ophthalmologist has much to offer in a cooperative effort in both instances, by eye muscle testing and the use of the exophthalmometer before, during and subsequent to surgery. It should be self-evident that local anesthesia is necessary to permit patient cooperation.

Another aspect of the problem that requires consideration is the age of the fracture preceding surgical intervention in relation to the type of procedure to be undertaken. It is seemingly widely accepted that depressed fractures of the orbit and zygoma require early reduction within five to ten days in order to avoid fixation in malposition. Con-

sideration should be given to the usefulness of the simple temporal approach even in older fractures of the zygoma, and the procedure should not be limited solely to depressed fractures of the zygomatic arch; open reduction and interosseous fixation may well be reserved for the instances in which a satisfactory reduction will not maintain itself spontaneously.

ANATOMY OF THE INFERIOR RECTUS AND INFERIOR OBLIQUE MUSCLES

To evolve a rationale for the treatment of orbital fractures it is important to have a basic understanding of the involved eye muscle anatomy and function. The floor of the orbit (Fig. 1) is elevated and is paper thin. The inferior oblique muscle (Fig. 2) arises from the margin of the inferior orbital rim and travels behind the globe to insert in the globe. From a simple mechanical point of view, it is obvious that if the origin of an extraocular muscle be moved toward its insertion, then underaction of this muscle will take place. Hence, if there is a fracture of the inferior orbital rim, the origin of the inferior oblique muscle will be displaced posteriorly, resulting in underaction of this muscle and manifested by limitation of elevation of the globe, particularly in upward and inward gaze of the affected eye. This will result in vertical diplopia.

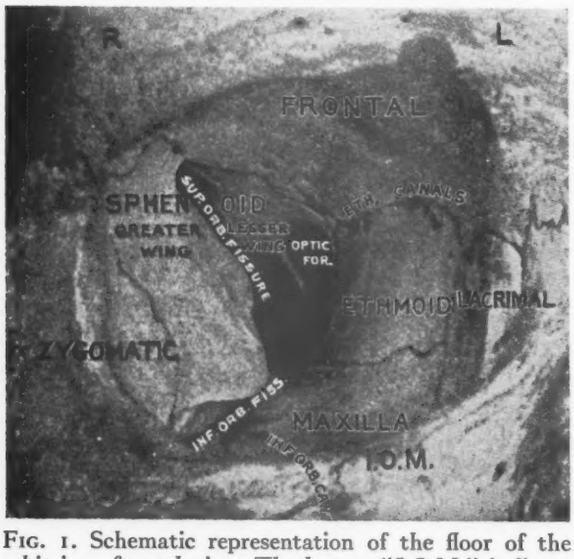

FIG. 1. Schematic representation of the floor of the orbit in a frontal view. The letters "I.O.M." indicate the site of origin of the inferior oblique muscle on the maxilla. (From: WHITNALL, S. E. Anatomy of the Human Orbit, 2nd ed. Revised by Johnson, W. London, 1932. Oxford University Press.)

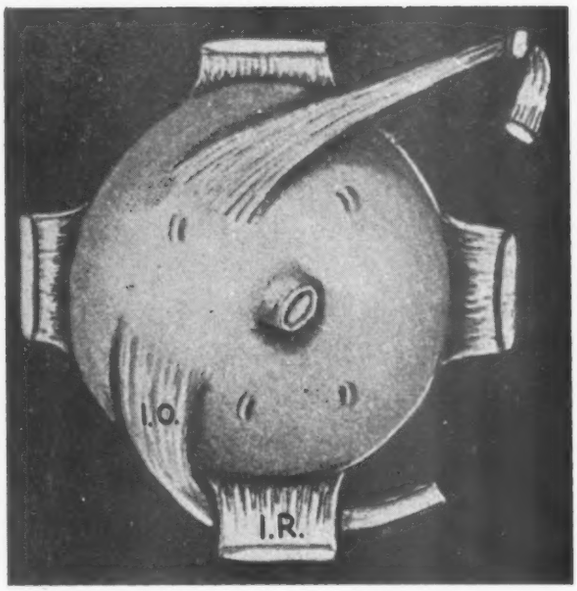

FIG. 2. Schematic drawing from the posterior aspect of the eyeball. The letters "I.O." indicate the inferior oblique muscle running inferior to the inferior rectus muscle (letters "I.R."). (From: BERENS, C., editor. The Eye and Its Diseases, 2nd ed. Philadelphia, 1949. W. B. Saunders Co.)

Next most common in fracture of the orbital floor, the inferior rectus muscle becomes incarcerated in the wound of the orbital floor fracture as the orbital contents herniate into the maxillary sinus, thus limiting the muscle action. In such instances, inability to depress the globe (particularly in the out and down direction) results in vertical diplopia.

The lateral canthal ligament plays no part in the vertical diplopia of orbital fracture. It would be concerned with the lateral recti muscles, and horizontal but not vertical imbalance.

It is commonly stated [2] that if a fracture of the lateral wall of the orbit is above the attachment of the palpebral ligament, the downward displacement of the zygoma will lower the outer canthus producing a vertical diplopia. In our opinion, this is not sound since with the fracture of the region, there must be involvement of the inferior oblique muscle origin and it is the effect on the latter that induces the vertical diplopia. It must be evident that vertical diplopia can occur without fracture of the lateral orbital wall or a possible effect on the lateral palpebral ligament, since such vertical diplopia occurs with a "blow-out" fracture of the orbital floor and no zygomatic fracture.

TESTS FOR EYE MUSCLE FUNCTION

Definitive measurement of eye muscle function should be performed before operation. Local anesthesia is the anesthesia of choice, so that further measurements can be made at the operating table with the cooperation of the patient. This is done as follows, before and after reasonable reduction of the fractures: (1) screen cover testing in the cardinal fields of gaze; (2) screen comitance; and (3) use of the exophthalmometer.

In eye movements, yoke muscles are referred to, for example, in looking up and to the left, the left superior rectus and right inferior oblique muscles are known as "yoke muscles" in that cardinal field of gaze. Cardinal fields of gaze are those directions in which an extraocular muscle operates in its main field of action with little or no secondary action. Therefore, in screen cover testing and commitance, the yoke muscles are tested for evenness of action, and at the operating table indications are clear to avoid over- or undercorrection of fractures.

The exophthalmometer (Fig. 3) is used to study the protrusion of the globes by direct measurement. This is particularly important in repairing the orbital floor and helps to determine the amount of packing necessary to correct any remaining diplopia and enophthalmos after correction of orbital rim fractures, and thus to place the globe into its normal anatomical relationships.

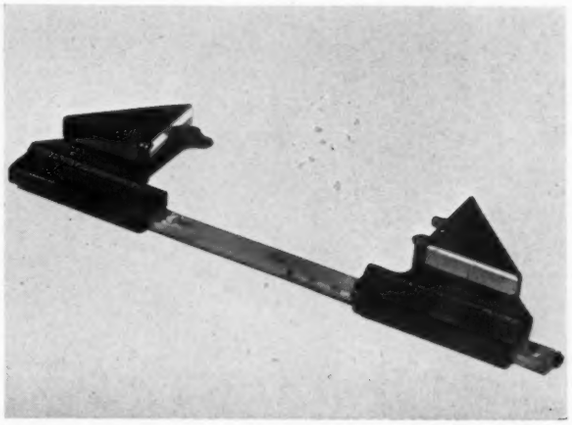

FIG. 3. The exophthalmometer, an instrument used for direct measurement of the anteroposterior position of the eyeball in relation to the lateral orbital margins.

CASE REPORTS

CASE I. M. M., a thirty year old woman, had a history of a fall at home and an injury to the left eye region. On admission she was found to have moderate ecchymosis and edema of the periorbital region and left eyelids. There was a vertical diplopia, particularly marked in the left upward gaze, left enophthalmos and crepitation on periorbital palpation. It was believed that the left orbital floor was fractured with incarceration of the left inferior rectus muscle, thus holding the globe down and limiting vertical movement.

X-ray examination with the patient in the Waters position (Fig. 4) showed a malformation extending into the roof of the left antrum. The findings were consistent with a comminuted fracture of the medial floor of the left orbit. There was no fracture evident in the zygoma or other facial bones.

Operation for reduction was undertaken two days after injury. With the patient under local anesthesia and sedation a Caldwell-Luc procedure was performed. The floor of the orbit was found to be depressed and markedly comminuted. The floor was elevated without difficulty and held in position by antral packing. Eye muscle function was checked at the operating table, the packing was readjusted, and testing showed correction of the enophthalmos and diplopia.

The patient's postoperative course was uneventful and there was no complaint of diplopia following the reduction. A subsequent recheck of the muscle status, following removal of the antral packing on the tenth day, showed the muscle balance to be within normal limits. The postoperative x-rays show the correction in the depressed fracture of the orbital floor with some residual thickening of the maxillary sinus apex. (Fig. 5.)

CASE II. A. Y., a fifty-eight year old woman, sustained facial injuries in an automobile accident. On admission she was found to have marked edema and ecchymosis of the left side of the face, eyelids and nose. Clinical examination showed a depressed fracture of the zygoma and infraorbital border, and a comminuted fracture of the nose. There was a complaint of diplopia. The extraocular motility was disturbed with some loss of elevation and horizontal movements in the left eye, resulting in diplopia in the left cardinal fields of gaze. There was an enophthalmos of the left eye.

X-rays of the facial bones (Fig. 6) showed a marked depression of the infraorbital ridge, a depressed fracture of the zygoma with separation and hemorrhagic clouding of the left antrum. Associated fractures of the wrist and fibula were treated by an orthopedic surgeon.

Operation was performed on the day following the injury. With the patient under local anesthesia and sedation, a Gillies temporal approach reduction was undertaken and achieved without difficulty. The ocular motility was checked during and sub-

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FIG. 4. Case I. Preoperative x-ray showing a comminuted fracture of the left orbital floor with no associated fracture of the zygoma or orbital border. There was vertical diplopia and enophthalmos.

FIG. 5. Case I. Postoperative x-ray following a Caldwell-Luc reduction of the isolated depressed fracture of the orbital floor. The diplopia and enophthalmos was corrected.

sequent to reduction, and showed excellent restoration of normal anatomical relationships with loss of the diplopia, full motility and correction of the enophthalmos.

The compound comminuted fracture of the nose was elevated, manipulated and splinted.

The patient's postoperative course was uneventful with resorption of the facial edema and ecchymosis. Healing was satisfactory and there was no recurrence of the diplopia. Check x-rays taken postoperatively (Fig. 7) showed good position of the zygoma and infraorbital ridge and a clear antral cavity. The ocular motility was tested periodically postoperatively and was found to remain within normal range.

CASE III. M. G., a forty-six year old woman, had a history of injury to the left side of the face

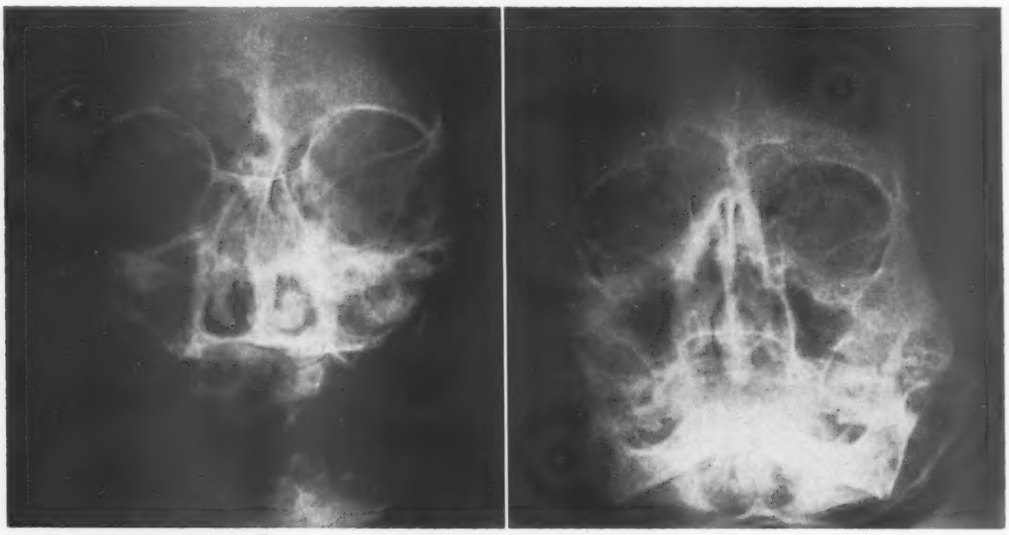

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FIG. 6. Case II. Preoperative x-ray showing a depressed fracture of the left zygoma and a comminuted fracture of the nose. There was a vertical diplopia and an enophthalmos.

FIG. 7. Case II. Postoperative x-ray showing correction of the fracture of the left zygoma obtained by the temporal approach alone. There was no further diplopia or enophthalmos.

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FIG. 8. Case III. Preoperative x-ray showing a depressed fracture of the left zygoma and infraorbital border. There was vertical muscle imbalance and diplopia.

FIG. 9. Case III. Postoperative x-ray showing correction of fracture of left zygoma by the temporal approach alone. There was no further diplopia.

due to a fall. On admission the patient was found to have edema and ecchymosis of the left eyelids and periorbital region. There was a complaint of diplopia, and ocular examination showed vertical muscle imbalance with double vision most marked in upward gaze and right lateral gaze.

X-rays of the facial bones (Fig. 8) showed a depressed fracture of the left zygoma and infraorbital border, with hemorrhagic clouding of the left maxillary sinus. The patient was known to have diabetes.

Operation was performed on the day of injury. With the patient under local anesthesia and sedation, a Gillies temporal approach reduction was undertaken. The ocular motility again was checked during and subsequent to reduction, and showed loss of the diplopia with restoration of normal muscle function.

There was an uneventful resorption of the edema and ecchymosis postoperatively and no further complaint of diplopia. The postoperative check x-rays (Fig. 9) showed a satisfactory reduction and maintenance of the repositioned bones.

The ocular motility was examined periodically and showed restoration of normal function with no residual imbalance.

CASE IV. J. M., a forty-two year old man, sustained an injury to the left side of the face. There was a protracted delay in seeking aid in spite of diplopia and difficulty in opening the mouth. The patient was admitted to the hospital thirty-three days following the trauma. Clinical examination showed a depressed fracture of the infraorbital border and left zygoma with a pronounced deformity at the zygomaticofrontal suture line. There was anesthesia in the distribution of the infraorbital nerve. Ocular examination showed a vertical muscle imbalance in all cardinal fields of gaze with a complaint of double vision. The imbalance was most marked in the right upward gaze and there was a left enophthalmos.

X-rays of the facial bones (Fig. 10) taken thirty-one days following the trauma showed a depressed fracture of the zygoma and infraorbital border. There was overriding at the zygomaticofrontal articulation.

An interval of thirty-three days intervened between the date of injury and the hospital admission. Previous experience had indicated success in reduction of zygomatic fractures by the temporal approach in older fractures. The previous maximum interval attempted successfully by this method had been twenty-four days post-trauma. It was planned in this instance to attempt to disimpact the fragments by the temporal approach, to follow with open reduction and direct bone wiring of the displaced zygomaticofrontal region, and to correct the antral border and floor by the Caldwell-Luc procedure.

The operation was undertaken the day following hospital admission, a total of thirty-four days post-trauma. With the patient under local infiltration anesthesia and sedation, a Gillies temporal approach was used and the zygoma was mobilized with surprising ease. Open reduction and direct bone wiring was performed at the zygomaticofrontal suture line to correct the overriding and to support the position of the zygoma. Examination at the operating table at this time showed good contour of the face by palpation,

10 11

FIG. 10. Case IV. Preoperative x-ray taken thirty-one days post-trauma to the left face, showing a depressed fracture of the left zygoma with pronounced separation at the zygomaticofrontal suture line. There was a vertical diplopia and enophthalmos.

FIG. 11. Case IV. Postoperative x-ray following reduction by the temporal approach and direct bone wiring at the zygomaticofrontal suture line thirty-four days following trauma. The diplopia was corrected except for extreme right lateral gaze, and the enophthalmos was corrected.

but an equivocal complete correction of the ocular motility because of poor cooperation of the patient. The diplopia was generally relieved and what motility could be measured showed improvement of extraocular muscle function. Since the diplopia had persisted for thirty-four days and the visual findings were not conclusive, it was decided to defer the third stage of the contemplated correction, the open antral approach, until a later date and further evaluation.

The patient's postoperative course was uneventful and the healing was satisfactory. Ocular motility showed some diplopia in extreme right lateral gaze. The patient was content and had no double vision in all useful fields of gaze. There was no enophthalmos.

It was believed that no further operative intervention was indicated. X-rays taken postoperatively showed a satisfactory reduction of the fractures. (Fig. 11.)

COMMENTS

There are only two essential mechanisms by which a fracture may occur in the orbital floor without fracture of the orbital rim. The earlier concept [3,4] held that the force of a blow to the region was conducted directly through the bone. More recently it has been held [5–7] that if the force is applied within a certain range, the pressure is exerted within the orbital contents and the weakest area, the floor of the orbit, will fracture. This mechanism is illustrated clinically by Case 1. The tendency exists not only because the bone is only about 0.5 mm. in thickness but also because anatomically the orbital floor forms a convex bulge behind the eye. The contents of the orbit and the eye will drop into the maxillary sinus with the resultant symptoms and signs. With greater force, the orbital rim also will fracture and damage to the globe may occur. The cadaver experiment described by Smith and Regan [1] presents good evidence that the pressure of the orbital contents against the floor causes the orbital floor fracture. Furthermore, fracture of the orbit can be found in every case of traumatic enophthalmos [5].

Diagnosis of the fracture of the orbital floor without fracture of the orbital rim or zygomatic compound is not difficult if there is adequate awareness of the clinical possibility. The history

of injury, the presence of diplopia and radiographic evidence of the depressed fracture into the antrum, with no fracture of the orbital rim or zygoma, are adequate for diagnosis. Examination with the patient in the routine Waters or Caldwell position may be inconclusive if there is marked antral clouding. Laminagraphy may or may not be of value [*1,7*]. Direct examination of the orbital floor by the orbital or the Caldwell-Luc approach is not essential for diagnosis and may be undertaken only when it is indicated for reduction. The clinical symptoms and signs will be present even in the presence of antral clouding.

Methods of early treatment of zygomatic fractures have been numerous and tend to fall into a number of categories such as: (1) intraoral approach via the buccal fold [*8,9*] or via the antrum [*12*]; (2) external approach via the temporal region [*13–15*], via the nose [*16,17*] or via the face [*18*]; (3) retention devices such as a balloon in the antrum [*19,20*], head traction [*21,22*], cartilage implantation [*23*], needle fixation [*24*] or bone implantation [*6,23,25,26*].

Fractures of the zygoma and zygomatic arch may require relatively early treatment but are not to be considered as surgical emergencies. Cases II and III illustrate the common form of zygomatic fracture associated with diplopia. Frequently there are associated injuries with danger of hemorrhage, shock or asphyxia which require prior attention. The attempt at reduction should be made when the general condition permits. A high incidence of associated injury has been indicated by Coakley and White [*27*]. They report an incidence of 26 per cent concussion, 22 per cent facial laceration, 14 per cent mandibular fractures, 11 per cent maxillary fractures and 9 per cent nasal fractures. Dingman and Harding [*28*] do not consider cerebrospinal fluid rhinorrhea of itself a contraindication to correction of facial bone fractures, and they have successfully treated several patients without complications.

In patients with a history of trauma to the face, it is well to look for the signs and symptoms of a fracture of the orbit, zygoma or zygomatic arch. They are frequently masked by marked edema and ecchymosis and may be overlooked. If a question arises clinically, x-rays taken with the patient in the Waters position are valuable for the bones of the middle third of the face. Any correction indicated should be undertaken because a residual facial deformity imposes a definite handicap from the psychological, social and economic viewpoints.

The zygoma has four articulations and these coincide with the common sites of fracture, since the bone itself is dense and trauma is transmitted to the articulations. These articulations are the frontal process at the superior external orbital margin, the orbital process in the region of the infraorbital foramen, the zygomatic arch with zygomatic process of the temporal bone, and the zygomatic process of the maxilla at the anterior antral wall. With mild trauma, a simple fracture at the suture line may occur and the zygoma may not be displaced. Displacement is, however, ordinarily found with fracture and may occur outward if the force is posterior on the zygomatic arch; medially and superiorly if the force is lateral and upward, and will induce fractures in the region of the infraorbital foramen; or backward, downward and inward if the force is lateral and downward. The last is the most common displacement, with the maxillary articulation remaining intact and the thin outer wall of the maxillary sinus being impacted.

The various methods of correction of the fractures of the zygoma also can be divided into attempts at intra-antral and extra-antral reduction. An early method of intra-antral reduction was introduced by Lothrop [*10*]. He used an exposure through the canine fossa and reduction by direct pressure. An early method of extra-antral reduction was given by Matas [*18*] who used a strong silver wire passed around the zygomatic arch for reduction of fractures in this area. Other methods used involve the use of dental forceps on the malar body to manipulate the fragments into position; this preceded the towel clip technic for reduction which is sometimes used at this time. Forceps, metal corkscrews and a conical screw also have been used for reduction. Blunt instruments have been applied for reduction through the deep surfaces of the zygoma by way of an incision in the superior portion of the buccal sulcus for introduction of an elevator, or beneath the zygoma through an incision just below the external canthus. The Caldwell-Luc approach

was used for reduction by Kazanjian [21]. This approach and the various screw devices in the malar bone allow for maintenance of position by application of traction devices.

In selected cases the incision can be made over the fracture lines of the lateral and inferior orbital ridges, and direct wire fixation can be performed. The use of such internal wire fixation of facial fractures as recommended by Adams [29,30] has found wide usefulness and acceptance. Headcaps and external appliances are avoided, with resultant greater comfort to the patient and firmer fixation of the fracture fragments. Facial scarring occurs when pins or wires are brought out through the skin from their attachment to the facial bones. If the temporal approach is inadequate for reduction in a depressed fracture of the zygomatic compound, as illustrated by Case III, it may be supplemented by interosseous wiring at the zygomaticofrontal suture line. This procedure ordinarily will be adequate for an anatomical and functional result, but may be supplemented further by interosseous wiring at the infraorbital border. Walden et al. [31] prefer the temporal approach for a depressed fracture of the zygomatic arch. If the infraorbital ridge and zygoma are involved they use the Caldwell-Luc procedure and antral packing, supplemented by direct bone wiring in the infraorbital area when necessary. Kostrubala [32] prefers direct bone wiring at the outer orbital rim.

Tanzer [22] notes that subjective manifestations of zygoma fracture are often inconspicuous and may consist only of swelling, subconjunctival hemorrhage and moderate discomfort. There may be numbness in the infraorbital nerve distribution since the infraorbital canal creates a weak spot in the ridge, through which a fracture line may extend. Antral hemorrhage may occur but usually is not prominent. Diplopia may be caused by orbital hemorrhage or, if more severe, may cause displacement of the ocular globe. If posterior displacement occurs, some degree of trismus may result due to compression of the temporal muscle or, rarely, due to impingement upon the coronoid process of the mandible. The early flattening of the cheek as an objective finding is usually obscured by ecchymosis and edema after the first few hours, as may the palpable evidence of fracture along the orbital ridges of the zygomatic process. Bulging into the superior buccal sulcus and occasionally crepitation may be found with digital examination of the oral cavity. Early treatment of the less severely comminuted fractures cause the restored fragments to lock into position and they do not require supplemental support. A firm pack introduced into the maxillary antrum, when the intraoral approach has been used, allows for adequate splinting until fibrosis holds the zygoma in its proper relation.

Dingman and Harding [28] are concerned with malunion of the zygomaticomaxillary compound after fibrous fixation makes manipulation for reduction difficult or impossible. In such fibrous union they recommend mobilization by freshening the fractures with an osteotome inserted through small incisions. Access to the arch of the zygoma is gained by the temporal route or through a 1 cm. incision just below the lower border of the zygoma. The site of the zygomaticofrontal suture is exposed through an incision in the lateral portion of the eyebrow, and the zygomaticomaxillary suture and infraorbital margin by a small transverse incision below the infraorbital margin. If necessary, the lower part of the zygomaticomaxillary suture is exposed subperiosteally through an intraoral approach. They recommend wiring the fragments directly by the Adams method. If diplopia has occurred, the attachment of the inferior oblique muscle at the anteromedial aspect of the orbital floor should be elevated if it is found depressed. A comminuted orbital floor is held in support by antral packs. If, however, solid fixation has already taken place, the depression of the orbit can be minimized by inserting an implant of bone or cartilage beneath the periosteum of the floor but cannot give more than gross improvement of vision.

Moore and Ward [33] report that poor results are obtained with substitution and camouflage methods in old fractures of the facial bone, particularly in correction of diplopia. They report twenty-two successful cases of correction of diplopia of a total of twenty-six cases of refracture and reduction of malunited fractures. A stainless steel jackscrew had been recommended for insertion into the maxillary sinus [33] by way of the canine fossa region for unrecognized or inadequately treated depressed orbital fractures

that heal with persistent diplopia. This splint may be removed in three months or may be left *in situ* permanently.

Early primary correction of "blow-out" fractures of the orbit by immediate autogenous bone grafting is recommended by Converse and Smith [*1,6,7,26*]. It is of interest to note that in abstracting the last paper for the *International Abstracts of Plastic and Reconstructive Surgery* an editorial comment was added that "it hardly seems justifiable to advocate the radical management by bone graft of the orbital floor in every case of comminuted fracture of the orbital floor." It is likely that bone grafting procedures have their major usefulness in cases in which bony union is firm with resultant deformity and dysfunction, and more conservative methods have failed.

The temporal approach for zygomatic reduction [*13*] is favored because of its simplicity and effectiveness, and because the incision and resultant scar are hidden within the hairline. While the approach is free of important nerves that might be injured, a single instance has been reported in which there was subsequent monocular blindness [*35*]. This unfortunate occurrence was probably due to intraneural and intraorbital hemorrhage to compress the nerve. There was no evidence of a bone spicule as a cause of the postoperative blindness. Gordon and Macrae suggest that early splitting of the intraorbital portion of the sheath of the optic nerve might have saved some sight.

SUMMARY

1. Fractures of the orbital floor may occur clinically without fracture of the orbital rim or zygomatic compound.

2. Diagnosis of isolated orbital floor fracture involves a history of trauma, x-ray findings and visual dysfunction.

3. Treatment is best undertaken with the patient under local anesthesia and the assistance of an ophthalmologist to check the vision and muscle balance before, during and after the procedures. In this manner both undercorrection and overcorrection can be avoided.

4. Elevation of the orbital floor to a proper level for vision is feasible by antral packing if the primary attention is focused on achieving correction in vision and facial contour at the operating table. The need for early bone grafting and antral devices should be re-evaluated.

5. If the fracture of the orbital border is associated with fracture of the zygomatic compound, even late reduction without an antral approach may give satisfactory vision.

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Psychological Impact of Facial Deformities

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"The love of life is next to the love of our own face, and thus the mutilated cry for help."
Sushruta Samhita, India, 600 B.C.

THE face is an extremely important symbol of man although not the only one. When we think of a particular person, the first thing we are conscious of is his face. This seems rather strange when it is considered that the face comprises only about 3 per cent of the total body surface, yet the only time we are conscious of the other 97 per cent of the body is when it is deformed, maimed or twisted from what we call normal. When the face is deformed or discolored, not all the will power in the world will draw our complete attention away from the source of the facial abnormality.

Facial deformities are concealed with great difficulty and jeopardize the appearance of a person more seriously than do similar defects in other parts of the body. Because of this fact they are the most common disfigurements which produce psychic distress. A slight facial deformity frequently produces a psychological effect out of all proportion to the extent or appearance of the disfigurement.

How profoundly the conscious or unconscious association of mutilation and horror colors our thoughts and actions can hardly be estimated, but not many will dispute its enormous influence.

If we accept the principles of mental hygiene and the person as a functional unit, we are then bound to be as concerned about his mental welfare as we are scrupulous about our own surgical technic.

The fundamental principle of the task of helping the facially deformed patient is based upon the realization that the psychological stresses of any plastic and reconstructive problem involve two forces. First, we have the person with all the normal and natural responses. Second, we have the environment with its numerous impacts on the person, impacts which leave their mark in many ways and which produce a predictable and controllable response to each new and changing situation. Human beings are extremely important to a disfigured person struggling for rehabilitation. The attitude of society, friends, relatives, associates and even casual contacts has a tremendous influence upon the response of a patient, more so than is usually appreciated. One of the most important human beings in the world of the patient is his doctor. His ministrations must succeed not only surgically but also psychologically.

History is replete with many examples of the relationship between physical defects and deformities, and psychic distress. Michelangelo, one of the greatest painters of all time, suffered depressions and anxieties which were sometimes almost unendurable because of a facial disfigurement suffered in a boyhood encounter. Charles Steinmetz, the electronic genius of Schenectady, lived, for the most part, the life of a recluse because of his body deformity. However, both these men yearned for social contacts—just to be with people.

People who are badly adjusted to their disfigurements are constantly suffering from a feeling that others they meet are too busy concentrating on their disability rather than on what they may have to say. Because the disfigured person may become suspicious or self-conscious, the average person feels uncomfortable in his presence. The simplest way to eliminate an uncomfortable situation is to steer clear of it, and so avoid social contact with the disabled person as much as possible.

A distorted personality is too great a price to pay for grotesque features which may be transformed by simple surgical procedures. Much harm has come in the past through

failure to recognize the psychological aspect of deformities or disfigurements. Too many have too often been unaware of the serious handicaps imposed upon these unfortunate persons not merely by physical appearances but more especially by mental reactions which affect their personalities, social status and means of livelihood. In our society, psychosocial factors play an all-important role in creating and complicating the problems of facially deformed people. In our culture today social distinction is based upon many factors, including physical normality and attractiveness. People are subconsciously prejudiced against others with facial disfigurements. Thus, an obvious facial deformity is considered a handicap.

One of the fundamental difficulties associated with facial deformities is the impression imparted by virtue of appearance to others. The basic concept of society as to what is normally acceptable is fixed, and any deviation may be the cause of a negative reaction.

Some adults display pity for children with deformities but revulsion for similarly afflicted adults. It is not uncommon to witness an expression of repulsive disgust on the faces of some people who see for the first time a grossly disfigured or mutilated person, and yet almost immediately thereafter express pity.

The psychological reactions to deformities due to injury or disease occurring in adults are often much more severe than those which follow congenital disfigurements. Time has taught the congenitally deformed person to make some adjustments which are often sufficiently artful to hide the unhappiness they harbor in disguise. Acquired deformities, particularly those contracted during adult life, present more serious problems. Their sudden, unexpected occurrence brings a mental shock which is so acute that adjustments are quite often impossible. When the acuteness has worn off, these people with acquired deformities are less resentful but more frustrated because they once knew normality.

Distorted facial features are false clues to personality traits. People unconsciously create images of the facially deformed person and frequently mirror their impressions. A patient with facial paralysis was called a gangster because he spoke out of the side of his mouth. Another patient with extensive lymphedema of both lips was called an "imbecile" and a "moron." A top executive in a large construction company was labeled a "tough guy" because of a nasal deformity resulting from a crushing injury. A patient with paralysis of both upper eyelids was mistaken for a "dope addict." These are serious problems to the people so afflicted.

A person with a facial deformity such as cleft lip, congenital absence of an ear or jaw, or disfigurement due to a burn, cannot hide his problem. Not infrequently such people are regarded as inferiors and may be assigned a marginal or minority status. Opportunities available to others are often denied to them such as employment, advancement in business, social relationship and marriage.

In order to cushion themselves against humiliation and shame, and make themselves feel safer, these people may take one of several courses: (1) utilize the ostrich technic, e.g., ignoring questions, looking away, holding their hand over the deformity, withdrawing inward to become introverts; (2) become outwardly aggressive, sometimes with quite a hostile attitude; (3) attempt to cushion themselves against others by being exceedingly charming and friendly, sometimes with even a facetious remark about themselves. The latter action may tend to lessen the immediate tension and shock and so condition others toward acceptance.

People want to belong—they want to be accepted for what they really are, not judged by virtue of a facial disfigurement.

In childhood and early adolescence acceptance by playmates and associates implies an adequate demonstration of prowess. Nonacceptance creates a feeling of inadequacy.

There are three important psychological effects of deformity, whether congenital, traumatic or developmental: (1) inferiority and shame, (2) modification of self-expression and (3) antisocial tendencies.

Children are notoriously observant of the unusual, and are cruel; they have no inhibitions. A great deal of undue attention is invariably directed to any cosmetic abnormality possessed by a playmate. There is no attempt on the part of a child to conceal his curiosity or to refrain from ridiculing his afflicted companion. Whether his intentions are malicious or sympathetic, he will be openly frank in his discussions and opinions. In a less purposeful manner he will shun his de-

formed associate or will force him into an inferior status.

Speech difficulties in children also create problems of fear and hate, often with a desire for vengeance against their tormentors. Such children become withdrawn, shy, retiring, introverted and introspective.

A note of permanence is often added to these childhood stigmas by dubbing the deformed child with a derogatory nickname which refers to his defect.

Many of these unfortunate children develop a feeling of inferiority and a sense of shame, and these mental factors develop much earlier than is generally realized.

This feeling of inferiority usually becomes a serious problem when the child enters school. He is then brought to realize his difference from the other children and at that time is not able to acquire the intimate companionship he longs for and which is enjoyed by his playmates. As the child matures he becomes increasingly more sensitive. When adolescence is reached there has already been established a pessimistic philosophy of life, mixed with all sorts of peculiar personality traits; yet there are many children who have developed this feeling of inferiority and sense of shame and grow up with the desire for companionship. As much as they do not want to be with children who make fun of them, they still desire relationship with people. To satisfy this craving they seek children much younger than they. For example, the ten and twelve year old child will play with a four and five year old child. This is not a healthy picture from the standpoint of development.

Personality depends upon two fundamental drives: one is for self-expression, i.e., the ability and desire to express one's thoughts and feelings in a way that is pleasant and acceptable to others. The other drive is to live and act as their friends and associates do, in other words, to conform with accepted social standards. When these two factors coincide, a pleasing personality develops. The child with a deformity usually has every mental and physical faculty for self-expression possessed by other children, but because of his deformity he does not have the personal association so necessary for such expression because others avoid him or he withdraws into himself in order to save himself from being hurt.

Three things may happen to this child. First, the pressures may be too great for him to fight back; he becomes afraid and gives in, accepting non-expression as part of the price he must pay. Second, he may become an outgoing individual to satisfy or compensate for the hurt he feels inside. Third, under fortunate circumstances, he may substitute his suppressed modes of self-expression with others of equal or greater merit.

Equally important in the development of a child's personality is the child's acquisition of popularity. Before a handicapped child can gain recognition from his group, he must first overcome their feelings about his deformity. Fortunately, there are many children who can do this. Unfortunately, there are some children who are inclined to give in to these difficulties and make no effort to become one of the group. They become resentful toward their obstacles and mistreatment. They withdraw into a shell and become very lonely. Blame for their failure is either inwardly or openly placed on all manner of circumstances and people. They become antisocial. Behavior difficulties in children are often misinterpreted by well meaning parents who blame these difficulties on lack of companionship with persons of the child's age, frequent and/or serious illness of the child, difficult living conditions and the like. These children sometimes have a tendency to run away from home or they come home from play after dark in order to avoid other children's teasing and jibes. They have a feeling of insecurity and inadequacy.

On the other hand, some children are properly guided to develop a hobby. They become so obsessed with the idea that they excell in it. Others become outstanding athletes or learn to play a musical instrument with exceptional skill. These young people have learned to overcome their handicap and have gained the respect of their companions. They are happy individuals. Children with a cleft palate and cleft lip who do not have proper care and guidance sometimes grow up to hate their parents—hate them with a vengeance—and blame all their woes on them. Even with a good result, surgical correction is not the end of care for these patients. They need friendly understanding and even sympathetic understanding, but not sympathy. They need friends, confidence, and guidance as they grow up.

SUMMARY

Obviously, in a presentation such as this, all the psychological problems of facial deformities and their many ramifications cannot be covered. An attempt has been made to present some of the most common difficulties and to call more attention to this aspect of the problem, with the hope that additional consideration will be given to help these unfortunate people.

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Papillary Cystadenoma of Accessory Salivary Gland

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PAPILLARY cystadenoma is a tumor which may arise in any glandular tissue in the body but is most commonly found in the ovary and the thyroid. When encountered in salivary glands, it most often involves the parotid and less often the submaxillary gland. Its occurrence in the accessory salivary glands lining the oral cavity is relatively rare and has been reported infrequently [*1*].

Because this tumor is potentially malignant, it must be differentiated from the benign adenomas, mixed tumors and benign mucoepidermoid tumors, all of which are more frequently encountered and among which this tumor has sometimes been classified [*2*]. It has clear-cut histopathological features. It is, for instance, easily distinguishable from papillary cystadenoma lymphomatosum (Warthin's tumor) by the absence of lymphoid interstitial tissue. Skorpil [*3*] who made an elaborate study of papillary cystadenoma occurring in salivary glands believed that this was a distinct clinical entity, the tumor arising pathogenetically from the lining cells of the secretory ducts through a process of cytoplasmic metamorphosis. His analysis of eight cases indicates that it may occur at any age and even be congenital. Its predilection for local recurrence and in one case, peripheral spread through implantation, indicates its malignant potential.

CASE REPORT

P. V., a seventy-four year old housewife, presented herself for examination in March, 1951, with no other complaint than the presence of a lump inside the left cheek which she had noticed slowly enlarging for the previous four or five weeks. There was no pain or other symptoms associated with this. Except for a rather severe osteoarthritis for which she had been treated for several years, she was in good general health. She had undergone a left phrenectomy in 1950 as treatment for a diaphragmatic hernia. There was no previous occurrence of a tumor of the mouth or elsewhere.

Significant physical findings were localized to the oral cavity. A hard, partially fixed, nontender, grape-sized nodule was present inside the left cheek just anterior to the ascending ramus of the mandible. The overlying mucosa had a normal appearance. There were no adjacent lesions. No regional lymphadenopathy was detected. An x-ray film of the mandible revealed no abnormalities. The clinical impression was that of a mixed tumor of an accessory salivary gland and the patient was hospitalized for excisional biopsy.

This procedure was carried out under local anesthesia the following day. The tumor did not appear to be well encapsulated and was quite adherent to the adjacent tissue. It was therefore removed with a zone of surrounding tissue included in the specimen. Primary closure was accomplished by undermining the adjacent mucosa. On cut section, the tumor was found to be an irregularly shaped nodule 1.5 cm. in diameter; its surface was yellowish gray in color and was soft and friable. In the center were several pinhead-sized cystic spaces. The histological sections showed these cystic areas to be lined with papillary projections made up of large, clear, columnar epithelioid cells. (Fig. 1.) The interstitial tissue consisted of bands of highly vascular connective tissue mixed with thin strands of collagen. A thin, fairly well defined capsule separated the tumor from adjacent salivary gland tissue.

The pathological diagnosis was "Papillary cystadenoma of accessory salivary gland." It was pointed out by the pathologist that this was a potentially malignant lesion and for this reason the patient was followed up in the Tumor Clinic at regular intervals for five years. She was examined on September 12, 1956, and no sign of recurrence was found. She was then discharged as having had a "five year cure" but admonished to return at any time she felt anything unusual. On August 13, 1957, she returned because she had felt a small lump in the cheek two weeks previously.

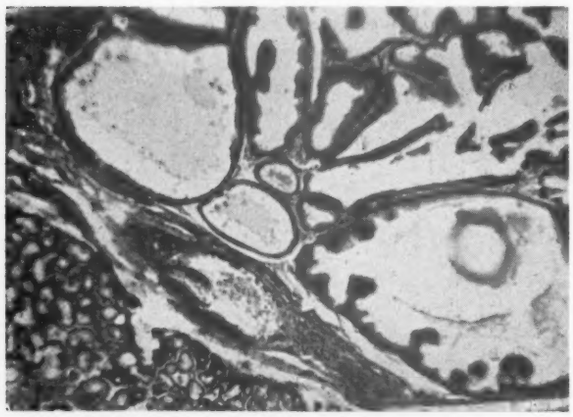

FIG. 1. Photomicrograph of papillary cystadenoma with adjacent salivary gland tissue.

This had rapidly become larger. Examination again revealed a nodule at the site of previous removal. The patient was admitted to the hospital and under local anesthesia the mass was excised widely. The pathological report was identical with that of the one made six and one half years before. The patient's postoperative course was uneventful. Because of her advanced years (now eighty-one years of age) it was decided that no more radical procedure be carried out. She is therefore again being watched for possible recurrence.

COMMENTS

This patient presented with a tumor which recurred six and a half years after previous removal. Both specimens revealed the identical pathological pattern of papillary cystadenoma, involving an accessory salivary gland. The potentially malignant nature of the lesion was recognized at the time it was initially diagnosed. A five-year follow-up, however, was insufficient to assure this patient of a "cure."

SUMMARY

1. A case of papillary cystadenoma of an accessory salivary gland is presented.

2. This is a rare and potentially malignant lesion as is evidenced by its recurrence in this case, six and a half years after it was first observed.

3. When encountered it should be treated, therefore, with radical removal, and the patient should be followed up with as great care as any other patient in whom a malignant tumor is found.

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Minimizing Postoperative Ecchymosis

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How long will the black eyes last? This is a question asked of the plastic surgeon by practically all patients contemplating rhinoplasty. I can now answer that the black eyes will almost certainly disappear within two weeks after operation. This reduction in the period of ecchymosis is due to the use preoperatively and postoperatively of the systemic hemostat, Adrenosem® salicylate.*

Prior to late 1957 I elevated the skin covering of the upper lateral cartilages, the nasal bones and the frontal processes of the maxilla with a scalpel. With this technic the ecchymosis of the eyelids developed progressively until the third postoperative day and then gradually disappeared during the next three to four weeks.

In an attempt to reduce the ecchymosis an aqueous solution of malonic and oxalic acids was administered to fifteen patients preoperatively and for four days postoperatively. No appreciable reduction in the extent or duration of the ecchymosis was noted. In three of these patients severe secondary hemorrhage developed twenty-four to forty-eight hours after the medication was discontinued. This is a much higher percentage than is usually encountered so this mode of therapy was discontinued.

Reports on the efficacy of the antihistamines in reducing edema following mechanical trauma and surgery have appeared in the literature. Tripelennamine hydrochloride, 200 mg. daily in divided doses, was administered on the day before operation and for four days after operation to sixteen patients. The time of development of maximum ecchymosis was reduced from seventy-two to forty-eight hours postoperatively and the ecchymosis gradually disappeared in two to three weeks. In one patient a mild secondary hemorrhage developed forty-eight hours after operation. This was readily controlled by repacking the nose and increasing the pressure applied by the external nasal splint.

In the hope of obtaining better results, fifty-three patients were treated with Adrenosem salicylate. It is with this series of cases that this paper will be concerned.

PHYSIOLOGY, CHEMISTRY AND PHARMACOLOGY

Roskam [1] pointed out that spontaneous hemostasis is accomplished by the interaction of three phenomena: the formation of a white thrombus at the mouth of vascular wounds, the coagulation of blood and the contraction of arteries and veins. As blood escapes from the cut end of a minute vessel, a white thrombus is formed by the adherence of the platelets to the injured vessel wall and to each other. Any factor which decreases the platelet agglutination reduces the firmness of the thrombus. Adhesion of the endothelial cells to each other helps to prevent bleeding from cut capillaries. Localized vasoconstriction occurs adjacent to the site of an injury in an arteriole or venule and favors spontaneous hemostasis.

Adrenalin® administered intravenously at first prolongs the bleeding time and later shortens it. Investigation of this phenomenon by Derouaux, Roskam and their associates [1–7] at the University of Liege, Belgium, led to the conclusion that the hemostatic activity was due to the principal oxidation products of Adrenalin, adrenochrome and adrenoxine.

Adrenochrome is a very unstable product. The monosemicarbazone is stable but is poorly soluble in water. The use of sodium salicylate as a solubilizing agent results in a synthetic chemical, adrenochrome monosemicarbazone sodium salicylate, which is a stable, soluble compound retaining the hemostatic properties of adrenochrome. The name of this compound has been shortened to Adrenosem salicylate.

Adrenosem salicylate may be administered intramuscularly or orally. The intramuscular preparation may be administered intravenously if it is diluted at least 1:10 in a suitable vehicle. It is rapidly absorbed following

* Some of the Adrenosem salicylate used in the study was supplied by S. E. Massengill Co., Bristol, Tenn.

parenteral or oral administration. Elimination [8] occurs within twelve hours in the urine. A portion of the orally administered solution is eliminated in the stool.

Adrenochrome has no sympathomimetic action. Pulaski and associates [9] found that there was no alteration in the clotting time, prothrombin time, pulse wave velocity or skin temperature following its administration. Roskam [1] demonstrated that following parenteral administration of Adrenosem, maximum shortening of the bleeding time could be expected in sixty minutes and some effect was still present after 120 minutes. He stated that this effect on the bleeding time did not depend on any vasomotor or clotting property.

Sherber [10] used Adrenosem salicylate with success in bleeding due to hypertension, purpura hemorrhagica, pulmonary bleeding, familial hereditary telangiectasis, gastrointestinal bleeding, epistaxis and following prostatic and tonsil and adenoid surgery. He concluded that the drug is a potent antihemorrhagic factor in those conditions in which the integrity of the smaller vessels is interrupted.

Fulton et al. [11] found that Adrenosem decreased the susceptibility to the formation of petechiae following the injection of dilute moccasin venom into the cheek pouch of the hamster. This protection was not due to vasoconstriction. These studies and that of Prevost et al. [12] indicate that the hemostatic effect of Adrenosem salicylate is dependent upon a reduction in capillary permeability, a correction of excessive permeability and an increase in capillary resistance. The action may be on the intercellular cement of the capillary walls. Adrenosem salicylate may also cause retraction of severed capillary ends.

Many clinical trials [13–24] bear out the effectiveness of Adrenosem salicylate as a systemic hemostatic. There have been no reports of toxicity, contraindications or incompatibilities. Sherber [10] gave the drug to patients for eighteen months with no toxic effects.

Kuschinski and co-workers [26] reported that antihistamines may have an inhibitory effect on adrenochrome. Feinblatt and Ferguson [25] found that long-continued high dosage of Adrenosem in a controlled diabetic showed no effect on the insulin dosage required.

TECHNIC

Fifty-three patients received Adrenosem salicylate before and after rhinoplasty. The youngest patient was fifteen years old and the oldest was fifty-three. No history of abnormal bleeding was obtained preoperatively. Four patients were menstruating.

Each patient received 10 cc. (5 mg.) of Adrenosem syrup four times on the day prior to operation. One hour preoperatively an injection of 2 cc. (10 mg.) was given intramuscularly. Immediately postoperatively an intramuscular injection of 1 cc. (5 mg.) was given. Following this, 10 cc. of the syrup were administered four times a day for four days. If vomiting complicated the postoperative period, intramuscular injections of 1 cc. were administered every six hours until the patient was able to retain oral medication.

Anesthesia was obtained by a field block of the nose using 1% hexylcaine hydrochloride. Six drops of 1:1000 Adrenalin chloride were added per ounce. Packing soaked in the same solution was inserted into each nasal cavity.

In thirty-six patients the external nasal skin was elevated with a scalpel. Concomitant submucous septectomy was performed upon thirty-two of these patients. In seventeen cases the soft tissues covering the nasal bones and bases of the maxillary frontal processes were elevated subperiosteally with a Joseph elevator. All of these patients underwent concomitant submucous septectomy. The bony portion of the hump was removed with a saw and the frontal processes of the maxilla were fractured with an osteotome intranasally.

RESULTS

In the first thirty-six patients it was my impression that bleeding during surgery was much less than that usually encountered, and in no instance was it troublesome. This impression was shared by the assistants and the scrub nurse. In sixteen patients, in whom the soft tissues were elevated subperiosteally, bleeding was so inconsequential that suction was unnecessary throughout the procedure. No secondary hemorrhage occurred in these fifty-two patients.

One of the seventeen patients who underwent subperiosteal elevation of the soft tissues bled profusely throughout the procedure. A severe secondary hemorrhage occurred two hours postoperatively. This patient later admitted that she had previously had a severe hemorrhage following a tooth extraction. She had denied the hemorrhagic tendency preoperatively for fear that I would refuse to perform the rhinoplasty.

Ecchymosis of the eyelids reached a maxi-

1A 1B 1C 1D 1E

FIG. 1. Scalpel elevation of soft tissues. A, twenty-four hours postoperatively. B, forty-eight hours postoperatively. C, four days postoperatively. D, seven days postoperatively. E, two weeks postoperatively.

2A 2B 2C 3A 3B

FIG. 2. Scalpel elevation of soft tissues. Patient was fifty-three years old with dark hair and a dark complexion. A, twenty-four hours postoperatively. B, seventy-two hours postoperatively. C, two weeks postoperatively.

FIG. 3. Subperiosteal elevation of soft tissues. A, five days postoperatively. B, eight days postoperatively.

4A 4B

FIG. 4. Subperiosteal elevation of soft tissues. A, four days postoperatively. B, two weeks postoperatively.

5A 5B

FIG. 5. Subperiosteal elevation of soft tissues. A, twenty-four hours postoperatively. B, ten days postoperatively.

mum on the morning of the first postoperative day. By mid-afternoon all patients were able to open their eyes. The ecchymosis had subsided or only minimal traces remained after two weeks. (Figs. 1 and 2.) In the seventeen patients in whom the soft tissues were elevated subperiosteally only minimal traces of ecchymosis remained after one week. (Figs. 3 to 5.)

COMMENTS

The capillary ooze which may prove quite troublesome during rhinoplasty and submucous septectomy was effectively controlled by Adrenosem salicylate administered preoperatively.

Secondary hemorrhage occurred in one patient who, despite preoperative denial, had a history of a previous hemorrhagic episode. The fifty-two patients who did not exhibit secondary hemorrhage are too small a group to be significant.

Ecchymosis of the eyelids following rhinoplasty is due to a persistent capillary ooze. Adrenosem salicylate administered pre- and postoperatively effectively controlled this capillary ooze so that the maximum extent of ecchymosis was much less than had been previously noted, and the period needed for subsidence of the ecchymosis was markedly shortened.

SUMMARY

1. Previous attempts to minimize ecchymosis in patients who have undergone rhinoplasty are discussed briefly.

2. The physiology of spontaneous hemostasis and the chemistry and pharmacology of Adrenosem salicylate are reviewed.

3. The technic used in this study is described.

4. Preoperative and postoperative administration of Adrenosem to patients undergoing rhinoplasty resulted in decreased bleeding during the procedure and a reduction in the ecchymosis which customarily follows.

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The Use of Homogenous Bone Grafts in Mandibular Reconstruction

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WITH the increasing incidence of radical surgery for neoplasms of the oral cavity and associated structures, the reconstruction of residual deformities requires deliberate consideration by the surgeon. One of the most important foundation blocks of the face from both a cosmetic and physiological point of view is the mandible. Of necessity, portions of the mandible are often resected for neoplasms arising in its substance or in contiguous structures such as the tongue, floor of mouth and alveolus. This paper will present the results of recent experiences in the use of homologous bone bank grafts for reconstruction of the mandible. Although both the use of bank bone grafts and the concept of the importance of mandibular reconstruction have been well known for years, perusal of the literature reveals a paucity of recorded experience in the specific use of bone bank grafts to reconstruct the mandible.

There are two main avenues of approach to the problem of mandibular reconstruction: (1) reconstruction by means of foreign body protheses made of metallic or plastic material; and (2) reconstruction by bone grafting, which may be further subdivided into (a) autogenous bone grafting and (b) homogenous bone grafting.

The use of a metallic or plastic prosthesis has many desirable attractions. It is possible to mold the prosthesis into a carefully predetermined shape and size so as to give a natural contour to the mandible. It is easily stored and sterilized. Provisions can be made for solid fixation of the prosthesis to the remaining portions of the mandibular bone.

Several metals have been employed. Most of the clinical experience has been with Vitallium.® Tainai [*24*] presented one successful case report. Genest [*14*] reported several cases in which a Vitallium prosthesis was used to replace lost portions of mandibular bone with good results. Edgerton et al. [*12*] described mandibular reconstruction by means of a stainless steel bar, and Attie et al. [*1*] presented a single case report in which stainless steel mesh was used to replace lost mandibular substance. Careful examination of the cases presented, in a study of metallic prostheses by Walsh [*25*], leads to a conclusion that the results are far from satisfactory. Healy et al. [*16*] reported on the use of acrylic prostheses. Examination of their case reports reveals frequent failures of this method. In general, reports by Conway [*11*], Converse and coworkers [*9,10*], Byars [*4*] and Conley [*8*], give the impression that the long-term results of foreign body mandibular prostheses are not as satisfactory as bone grafting.

Although theoretically attractive, a foreign body prosthesis for replacement of mandibular bone faces two formidable hazards. First, it is located in a portion of the face that is constantly undergoing muscular strains in all directions; and second, the close proximity of the oral cavity often leads to infection and failure. Buried metallic devices have a definite place as temporary measures in stabilizing the mandibular fragments and maintaining the tongue and floor of mouth in a more physiological position in the immediate postoperative period. In several of the patients in the cases presented herein Kirschner wires were used in the immediate postoperative period for this purpose with good temporary results. However, infection frequently developed with resultant osteomyelitis and pain requiring removal.

The use of bone grafts in all parts of the body has been studied with increasing interest for the past hundred years since Ollier [*20*]

began to publish his studies on the transplantation of bone in 1860. A good short historical survey of the subject may be found in an article by Converse and Campbell [*10*]. The precise fate and importance of transplanted periosteal, endosteal and osteocytic cells has not been established conclusively. However, there is abundant clinical evidence that autogenous and homogenous bone grafts will bring about anatomical and functional union of bone where no such union could be expected. Thus, bone grafting has become a standard tool in the armamentarium of present day surgery.

The history of bone grafting in the specific problem of loss of mandibular bone is well summarized by Ivy [*17*]. Bardenhauer [*2*] is credited with the earliest report of a successful autogenous graft to the mandible in 1891. The bone graft in this case was carried in a pedicle flap from the forehead along with skin and periosteum. Sykoff [*23*] and Payr [*21*] reported on free grafts of autogenous bone to fill in mandibular defects. World War I naturally gave opportunities for studying larger series of various remedial measures for replacing lost mandibular bone. In 1919 Cole and Bubb [*5*] reported some of the Allied Forces' experiences in the use of bone grafts in ununited fractures of the mandible. Although progress continued in this field for the next twenty years, World War II created the need and the opportunities for extensive experience with mandibular bone grafts. In 1944 New and Erich [*19*] described their technic of autogenous bone grafts to the mandible. Macomber et al. [*18*] and Blocker and Weiss [*3*] reported on some of the experiences of the U. S. Army during World War II in the use of autogenous bone grafts for traumatic loss of mandibular bone. The results were gratifying in restoring these severely wounded men to normal lives in society.

In recent years, as the indications for radical surgical excision of neoplasms of the oral cavity have been broadened, mandibular reconstruction with bone grafts in this type of patient has received more attention. Byars [*4*] discussed the use of bone grafts to replace the ablated portions of the mandible and stressed the importance of postoperative fixation of the mandibular fragments. However, it was not stated whether autogenous or homogenous bone was used. Conway [*11*] presented two cases in which autogenous bone was used to reconstruct the mandible after radical surgery in the head and neck area. Conley [*6,7*] has clearly exhibited the value of bone grafts in reconstructing the mandible following its surgical excision.

It is our opinion that, as a general rule, bone grafting should be done one to two years following the original surgery when there is reasonable certainty that there has been neither local recurrence nor distant metastases of the disease. On occasion, however, when the disease is not an aggressively malignant one, e.g., patient H. A. (Case III), immediate bone grafting may be considered. It is interesting to note that Conley [*6,17*] has reported a rather successful series of patients in whom bone grafting was done at the time of operation for frankly malignant disease. There are both practical and theoretical disadvantages to immediate bone grafting. It is not an unusual occurrence that second and even third operations are necessary to deal with local recurrences of neoplasms in and around the oral cavity, and a bone graft in such situations would hinder the necessary surgery. It is also apparent that such procedures, of necessity, take additional time and involve more trauma and blood loss to the patient, who has already been anesthetized for several hours.

There are immediate obvious advantages in the use of homogenous bone bank grafts as compared to autogenous grafts. When using bone bank grafts one may choose beforehand the approximate size and shape of bone to be used. There is no necessity of performing a second operation to obtain a portion of rib or iliac crest; hence, operation time is shortened and blood loss decreased when material from the bone bank is used. If the bone graft is made unsuitable for use during the operation for any reason, e.g., accidental contamination, it is a far simpler process to obtain another bone graft from the bone bank than it would be to reoperate and resect additional bone from the patient. It is well known that the donor sites of bone grafts are often the source of much postoperative pain. When rib is chosen as the donor site, postoperative chest pain may be the cause of improper "pulmonary toilet" with its sequelae of atelectasis and pneumonia. If it can be shown that in clinical experience, the use of homogenous bone bank

grafts is as successful as autogenous bone grafts in mandibular reconstruction, then the use of homografts may be the procedure of choice in such reconstructive surgery.

The problem of autogenous vs. homogenous bone grafts has occupied investigators particularly in the field of orthopedic surgery for several years. Perusal of the literature reveals that the question has not been fully settled. In a recent publication concerning the fate of bone homografts in animals, Enneburg [*13*] states, "There are three well documented types of response to homogenous bones transplanted in experimental animals. (1) Portions of the homogenous transplant may proliferate, survive, aid in the incorporation of the transplant, and in all ways be the equal of autogenous transplants. (2) The homogenous transplant may not produce surviving proliferations but act merely as an inert mechanical framework for replacement by the host tissue. (3) The homogenous transplant may be rejected by the host and destroyed without aiding repair in any degree."

In clinical experience some investigators have reported excellent results using frozen homogenous bone grafts in general orthopedic surgery. Wilson [*26*] concludes, "The results obtained are identical with those from the use of autogenous grafts except that in some instances the healing appears to be a little slower."

It was natural that the possibilities of bone bank grafts for mandibular replacement aroused the interest of several investigators. Converse and Campbell [*10*] stated, "If homogenous cancellous bone were as satisfactory as autogenous bone the need for the removal of bone from the patient's ilium with the attendant discomfort would not exist. Until this fact is proved, however, fresh autogenous cancellous bone remains the material of choice." Ivy [*17*] wrote, "There seems to be little doubt that preserved homogenous bone fragments can be useful for filling cavities, where the question of re-establishment of continuity of a movable bone like the mandible is not involved, but until more definite evidence is available, we feel that it is wise, at present, at least, to depend entirely upon autogenous bone for restoring large gaps in the continuity of the mandible. This opinion may change as results of experimental and clinical experiences are made known."

The reports in the literature concerning the use of homogenous bone bank grafts for mandibular replacement are rather incomplete. Hayward and Rafinella [*15*] express a preference for the use of autogenous bone, but no evidence is cited for this choice. Converse and Campbell [*10*], in a discussion of bone grafts in facial surgery, state that in general the failure rate of homografts was approximately three times that of autografts. However, a comparison of failures between homografts and autografts in the specific problem of mandibular reconstruction was not mentioned. In addition, these authors state that the homografts used consisted of "leftover" cortical bone while the autografts consisted of cancellous bone, and this may well be a factor in contributing to the increased failure incidence in homografts. It is illuminating to note that in a discussion of their failures (autografts and homografts), Converse and Campbell [*10*] point out that in the four cases of mandibular bone grafting, two failures occurred in patients in whom reconstruction was attempted immediately following an extensive operation for a malignancy, while a third failure occurred in a patient who was very poorly nourished.

There is some evidence to indicate that failure rates of homografts may vary a great deal in a different anatomical location. Reidy's [*22*] report indicates that whereas thirteen of eighteen homografts to the nose were absorbed, only one of eight mandibular homografts ended in failure of this kind. It is thus quite probable that there are basic differences in various loci for bone homografts and they should, therefore, be investigated separately rather than treated as a conglomerate whole.

GENERAL PRINCIPLES USED IN SELECTION OF PATIENTS AND SURGICAL TREATMENT

As a rule, it is preferred that the reconstructive effort be delayed one to two years following mandibular resection for an aggressive neoplasm. Prior to reconstructive surgery a careful examination is made to exclude the presence of a recurrence of the disease either locally or systemically. It is also important that sufficient time be allowed to elapse after any periods of osteomyelitis of the remaining mandibular bone fragments; this occurs not infrequently when a Kirschner wire is used. The nutritional status of the patient should

be adequate and, if not, appropriate methods be employed to improve it. Often these patients suffer from suboptimal nutrition due to malfunction of their mouth parts. In such people wound healing cannot be expected to proceed in a normal fashion. Lastly, it should be mentioned that the patient should earnestly desire the surgical procedure. Unless the motivation of the patient for some correction of the deformity is strong, failure to obtain a perfect contour to the face may be interpreted by the patient as a complete failure. It has been our experience that the majority of patients are desirous of any bit of improvement that can be offered to them.

As with bone operations elsewhere, the prevention of infection is of paramount importance. Sepsis, suppuration, osteomyelitis and extrusion of sequestrae are the ultimate causes of failure of most mandibular grafts. Although Converse and Shapiro [9] presented cases in which autogenous bone grafts were placed in position via an intraoral route, we believe that placement of the bone graft upon a sterile bed enhances the chances of success. Although antibiotics are used postoperatively, they are considered an adjunct rather than a substitute for aseptic technic. Keeping out of the oral cavity has offered some difficulties on frequent occasions due to the fact that the remaining mandibular fragments are pulled superiorly and medially by unopposed muscles to lie just beneath a scarred oral mucosa. Careful and gentle dissection is needed to prevent inadvertent entrance into the oral cavity.

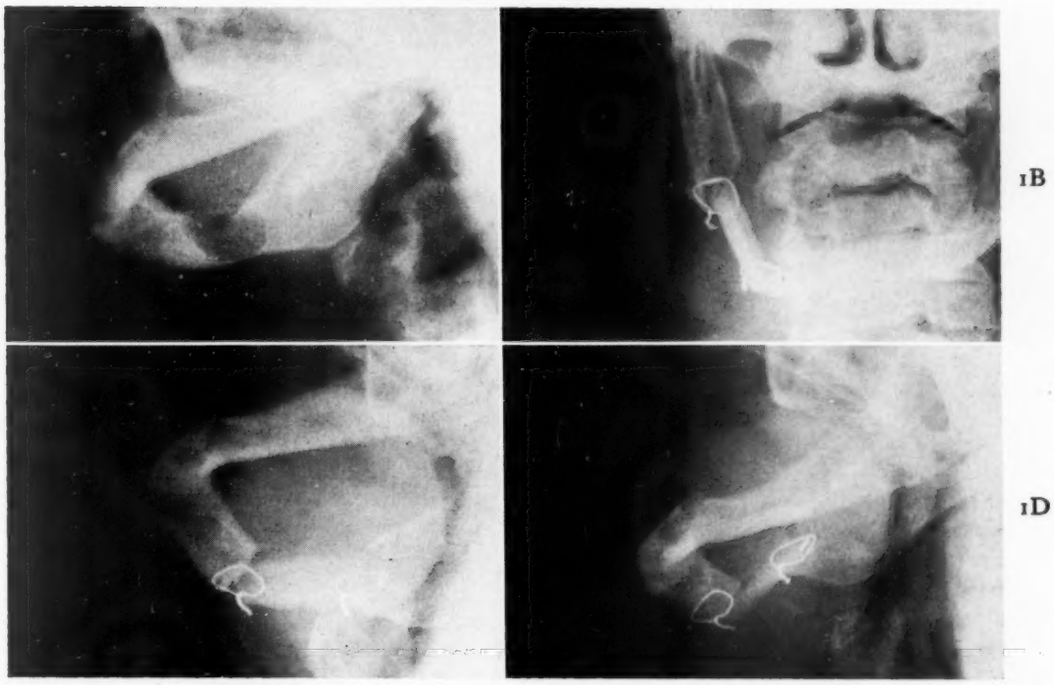
The principle of adequate immobilization, so important to bone healing everywhere in the body, must be adhered to in mandibular homografts. In several of the cases presented herein, intermaxillary wiring and rubber band fixation were used. When sufficient teeth are present for such a procedure, the resulting immobilization is secure and well tolerated by the patient. When teeth are not available other methods of fixation must be devised. In the one instance of failure in the series of patients presented (patient G. C., Case VI) the postoperative fixation of the mandibular fragments was not well maintained, and it is believed that this factor contributed at least in part to the resulting failure.

The operation is usually performed with the patient under endotracheal anesthesia. Two small submandibular incisions are used to expose the remaining portions of mandibular bone. By careful dissection the edge of the bone fragment is freed from the periosteum and scar tissue. This is done with care to avoid entering the oral cavity. The two operative fields are then joined by creating a "tunnel" with blunt dissection in the submental area. The bone bank graft is placed in this "tunnel" after having being previously cut and shaped to the desired contour. Drill holes are placed in both ends of the homograft and remaining mandibular fragments. The graft is fixed in place by means of stainless steel sutures. As outlined previously, additional fixation is needed for several weeks to allow time for union of the bone graft. While bony union demonstrable by x-ray is the ultimate desired result, a good functional result may be observed to be present prior to certification of bony union by x-ray examination.

The bone grafts used in the cases presented herein came from the bone bank maintained by the New York Orthopedic Hospital of the Columbia-Presbyterian Medical Center. In most of the cases, rib was used because of its availability. Its gently curved shape seems to fit the cosmetic requirements of a mandibular graft. The bone is frozen bone obtained from two sources: (1) sterile pieces of bone removed under aseptic conditions from operated patients and (2) bone removed from cadavers who have been dead for less than six hours. In the latter instance the bone is radiated. Bacteriological checks are made of bone obtained from either source. Donors with a history of malaria, jaundice, neoplasm and tuberculosis are excluded.

CASE REPORTS

CASE 1. V. P. (P.H. 307088), a twenty-eight year old Negro woman, was first seen at the Columbia-Presbyterian Medical Center in January, 1957, with a six-month history of a progressively enlarging mass on the right lower gingiva. Examination revealed a tumor mass originating near the angle of the right side of the mandible. On February 19, 1957, almost complete right hemimandibulectomy was performed. Pathological examination revealed the tumor to be an adamantinoma. Stabilization of the mandible was obtained by intermaxillary rubber band fixation which was released on March 4, 1957. On June 13, 1957, a bone bank homograft was used to fill the defect created by the original surgery. One end of the



1A 1B 1C 1D

FIG. 1. Case II. A, x-ray showing recurrent adamantinoma of the mandible. B and C, x-rays taken immediately after bone grafting. D, x-ray taken eighteen months following homogenous bone grafting showing solid bony union.

bone graft was wired to the mandibular stump while the other was placed in the temporomandibular fossa. Intermaxillary fixation was again used and this was removed on August 9, 1957. The patient had a satisfactory postoperative course. X-rays revealed the bone graft was in good position. There is no x-ray evidence of bony union as yet. Clinically the patient has a good mandible from both a cosmetic and functional point of view.

CASE II. E. R. (P.H. 611866), an eighty-two year old white woman was first seen at the Columbia-Presbyterian Medical Center in June, 1940. Her history dated back to 1928 when she had a "scraping" performed for a tumor of left lower gingiva at another hospital. In 1933 the tumor recurred and it was again "scraped." When examined in June, 1940, she again had evidence of a recurrent tumor of the left lower jaw, and local osteotomy and curettage of the left body of the mandible were performed. Pathological examination revealed an adamantinoma. In October, 1953, she again presented herself at the Columbia-Presbyterian Medical Center with evidence of a recurrent adamantinoma of the left body of the mandible. (Fig. 1A.) In October, 1954, resection of the body of the left side of the mandible was performed and a bone bank graft of tibial cortical bone was used to bridge the defect. (Fig. 1B and C.) The patient had an uneventful postoperative course. The function and appearance of the mandible was good. X-rays taken in May, 1956, revealed solid bony union. (Fig. 1D.)

CASE III. H. A. (P.H. 763805), a fifteen year old boy, presented himself for treatment at the Columbia-Presbyterian Medical Center in December, 1954, with the complaint of swelling of the right side of the lower jaw of three months' duration. A biopsy revealed the presence of fibrous dysplasia of the right body of the mandible. Because of an imminent pathological fracture of the mandible, partial resection of the right body of the mandible from angle to canine fossa was performed on February 12, 1957. A rib homograft was used to bridge the defect. Intermaxillary fixation was used postoperatively. This was discontinued on April 5, 1957. The patient had a good functional and cosmetic result when last seen in November, 1957. (Fig. 2.)

CASE IV. L. M. (P.H. 065477), a fifty-one year old Negro woman was admitted to the Columbia-Presbyterian Medical Center in October, 1951, because of evidence of a recurrent adamantinoma of the right body of the mandible. In 1933 an adamantinoma of the right mandible was curetted at another hospital. In 1945 a recurrence of the adamantinoma was again curetted. On October 17, 1951, the right body of the mandible was re-explored. The tumor mass was stripped

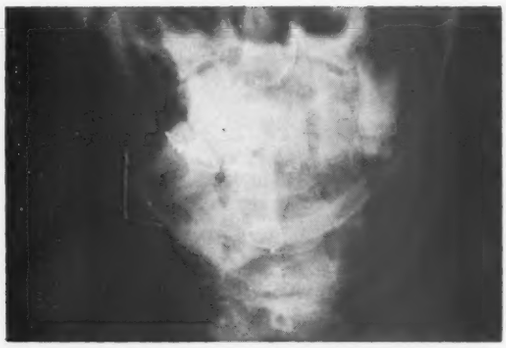
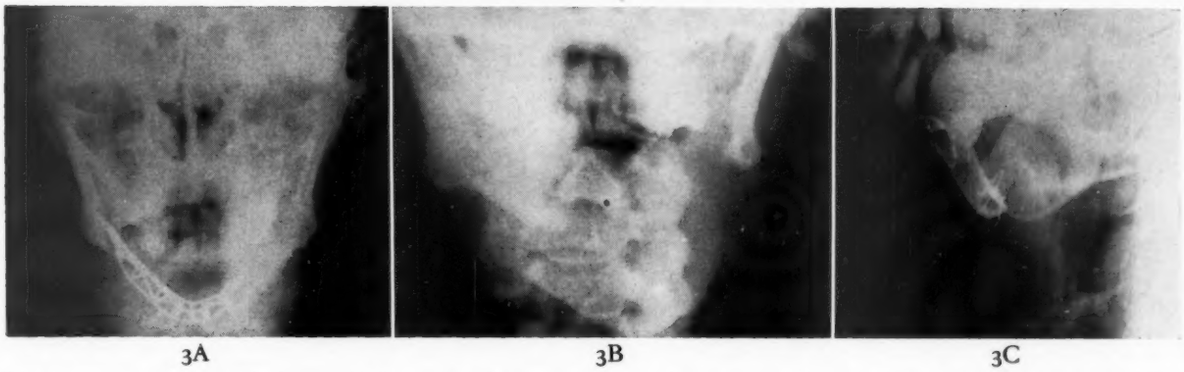


FIG. 2. CASE III. X-ray taken nine months after homogenous bone grafting.

externally from the periosteum of the mandible. The body of the mandible was transected, but no gross cystic changes were noted and it was decided not to resect the mandible. The iatrogenic fracture was wired together with stainless steel sutures. In December, 1953, a recurrence of the tumor was noted clinically in the operative area. On January 20, 1955, the right body of the mandible was resected from the midline to the angle. Pathological examination confirmed the diagnosis of recurrent adamantinoma. On February 9, 1956, reconstitution of the mandible was accomplished by means of a homogenous rib graft from the bone bank. The patient had an essentially uneventful postoperative course. Intermaxillary elastic fixation was used, and this was discontinued on April 6, 1956. The patient has had a good functional and cosmetic result from this reconstructive effort.

CASE V. E. Mc. (P.H. 266176), a fifty year old white man, was admitted to the Columbia-Presbyterian Medical Center because of an extensive squamous cell carcinoma involving the right anterior floor of the mouth and the right lateral area of the tongue. On April 6, 1956, hemiglossectomy, partial mandibulectomy, left supraomohyoid and right radical neck dissection were performed. A Kirschner wire was inserted in place of the resected portion of the mandible which extended from 1 inch proximal to the angle on the right to the canine fossa on the left. Tracheostomy and gastrostomy were performed at this time. X-rays on March 6, 1957, revealed penetration of the Kirschner wire through the bony mandibular fragment into the adjacent soft tissue. On March 29, 1957, the Kirschner wire was removed and an Esser inlay graft was applied in an effort to mobilize the tongue. On September 13, 1957, a rib homograft from the bone bank was used to reconstruct this huge mandibular defect. Two greenstick fractures were made in the rib homograft in order that a better contour could be obtained. The homograft was fixed in place by means of stainless steel sutures placed in drill holes. Fixation of the mandibular fragments was obtained by placing heavy steel wires through drill holes made in the angles of each side of the mandible and joining these wires behind the neck by means of heavy rubber bands. The patient had a satisfactory postoperative course. The rubber bands and stainless steel stay sutures were removed six weeks later. The functional result was improved. It is too early to expect any evidence of bony union by x-ray examination. From a cosmetic viewpoint there has been a marked improvement, but there is still a deformity due to the absence of a mental process of the mandible. Further surgery to substitute a mental process was planned at a later date for this patient. This may have to be postponed due to the appearance of severe peripheral arterial disease which has already required amputation of one lower extremity.

CASE VI. G. C. (P.H. 1259933), a fifty-two year old Negro man, was admitted to the Columbia-Presbyterian Medical Center in January, 1956, with a squamous cell carcinoma of the right half of the anterior third of the tongue which had extended to the floor of the mouth on the right. Partial glossectomy, partial mandibulectomy, left supraomohyoid and right radical neck dissection were performed. The resected portion of the body of the right mandible extended from approximately 1 inch proximal to the angle to the symphysis. A Vitallium prosthesis was used as a replacement for the resected mandibular bone. (Fig. 3A.) Tracheostomy and gastrostomy were performed at this time. The patient recovered from the operative procedure and was discharged from the hospital. In February, 1956, he was readmitted because of cellulitis in the floor of the mouth near the prosthesis. This infection subsided after antibiotics were given. In May, 1956, clinical and x-ray evidence of osteomyelitis of the right mandibular stump was noted. Because of this infection, the Vitallium prosthesis was removed with subsequent subsidence of the infection. (Fig. 3B.) On July 26, 1957, a rib homograft from the bone bank was put in place and fixed to the mandibular stumps by means of stainless steel sutures placed in drill holes. (Fig. 3C.) During the procedure the oral cavity was inadvertently entered. No fixation of the mandibular fragments was used postoperatively. On the fourth postoperative day there was purulent drainage from the operative site. No oral-cutaneous fistula could be demonstrated. The drainage is still present at the time of the writing of this report but it is beginning to lessen in amount. There is no x-ray evidence of osteomyelitis but the x-rays do reveal some slipping of the bone graft. The cosmetic result in this case is surprisingly good. Function is fair.



3A 3B 3C

FIG. 3. Case VI. A, Vitallium prosthesis put in place at the time of mandibular resection. B, x-ray following removal of Vitallium prosthesis revealing extent of mandibular defect. C, x-ray showing bone graft in place.

COMMENTS

The exact mechanism by which an autogenous or homogenous bone graft becomes incorporated into a functioning whole bony structure has not, as yet, been fully explained. However, from a practical clinical point of view there is a great deal of evidence that these grafts are successful and have a wide field of useful application in surgical attempts to reconstitute functional skeletal units. The advantages of homografts as opposed to autografts in terms of availability, versatility, and decreased operative time and trauma have already been mentioned in this paper. If it could be shown that the success rate for homografts were equal to that of autografts in reconstruction of the mandible, it would follow logically that homogenous bone grafts to the mandible would be the procedure of choice whenever a bone bank was available. It is surprising, therefore, that with the increase in the number of surgical extirpations of the mandible and with growing experience with the use of homografts elsewhere in the body, the recorded experience in the use of homografts for mandibular reconstruction is so sparse.

Although the number of patients presented herein is small, the results obtained thus far indicate that the use of homogenous bone bank grafts in reconstruction of the mandible is attended by a success rate comparable to that obtained with the use of autogenous bone grafts. The results obtained in five of the six cases presented herein may be considered as successful in that the patients had clinically improved function and appearance of the lower jaw. The remaining patient must be considered a failure. Although the appearance and function of the mandible have improved, the presence of purulent drainage presages failure.

It is interesting to note that in the solitary instance of failure, two cardinal points of operative technic were violated, i.e., the oral cavity was entered and adequate immobilization of the mandible was not obtained. As mentioned previously, adequate immobilization and an aseptic field are well established principles in orthopedic surgery. The mandible cannot be considered an exception to these axioms.

It should be emphasized that this is a preliminary report. In order to evaluate bone grafts properly in terms of function and appearance, follow-up study five to ten years postoperatively is necessary. This is true in judging not only homogenous bone bank grafts but also autogenous grafts and foreign body prostheses.

It is believed that the preliminary results obtained here with the use of bone bank homografts warrant their continued use for the repair of surgically produced mandibular defects.

SUMMARY

1. A brief history of bone grafts for mandibular defects is presented.

2. The advantages and disadvantages of foreign body prostheses, autografts and homografts in mandibular reconstruction are discussed.

3. The case histories of six patients with homologous bone bank grafts to the mandible are given. This treatment in five of the six patients is considered successful. In one patient the employment of homogenous bone bank is considered a failure due to suppuration.

4. Further use of homogenous bone bank grafts to the mandible is considered justified.

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Repair of Parotid Fistulas

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AN English fishmonger, in 1885, was always embarassed while opening oysters for his customers as he consistently developed a cutaneous flow of saliva down his cheek. Many years before he had received a slashing laceration of the cheek which never healed.

Several attempts were made to close the fistula by the use of nitric acid and silver wire cautery. He consulted his physician who discovered that there was no communication with the mouth. He was permanently cured when the cheek was doubly pierced with a piece of heavy silk thread and tied tightly on the mucous membrane side. The pressure of the suture allowed a fistulous tract to form, by necrosis, into the mouth thereby permitting the external wound to heal [1].

Since that time, innumerable methods have been reported to correct this annoying defect, all using some variation of the aforementioned technic, including severing the auricular temporal nerve [2] and x-ray therapy [3], to either dry up the salivary stream or hopefully wait for healing.

In many instances, failures from repeated operations have resulted in an attempt to reconstruct the original duct system, particularly the primary and secondary ducts with end-to-end anastomosis. The failures usually were due to occlusion of the main duct by the formation of scar tissue, thereby damming the salivary stream and causing pain, swelling and secondary infection of the gland.

The causes of parotid fistulas or occlusion of the duct system in our series of ten cases resulted from incision and drainage of abscesses, stones too large to pass with consequent infection and stricture, the severance of the main and minor ducts by the surgical scalpel in the removal of tumors, and cuts from switchblade knives and windshield lacerations.

It is of considerable interest that not one parotid fistula has been seen in more than 100 radical dissections of the neck gland we have performed for oral carcinoma. The tail of the parotid is usually removed in this procedure and all wounds have healed without salivary complications.

There are many fistulas that heal spontaneously and every effort should be made to achieve this result. The cases reported herein involved fistulas or occluded ducts that have either been operated upon or whose system would not remain patent after removal of stone due to cicatrix.

Patient H. D. was struck in the face with a piece of shrapnel while on combat duty in the E. T. O. He was given first aid treatment and the wounds of the face closed primarily. A parotid fistula developed through a dense cheek scar and the wound failed to heal after two years of conservative therapy. This was corrected as illustrated in Figures 1, 2 and 3.

A mucous membrane pedicle graft was elevated from the buccal surface of the cheek with its base located posteriorly [4]. The defect from which it was elevated was closed primarily. A channel was then made through the full thickness of the cheek to the cutaneous facial fistulous opening. The pedicle was threaded through the cheek to line the new channel with epithelium. No attempt was made to tube the graft. The free end was sutured to the subcutaneous tissue in the region of the fistula, the scar excised and the wound closed. A probe could easily be passed from the mouth to the source of the saliva. Healing was uneventful and the flow of saliva was satisfactorily by-passed into the mouth by this trough-like channel.

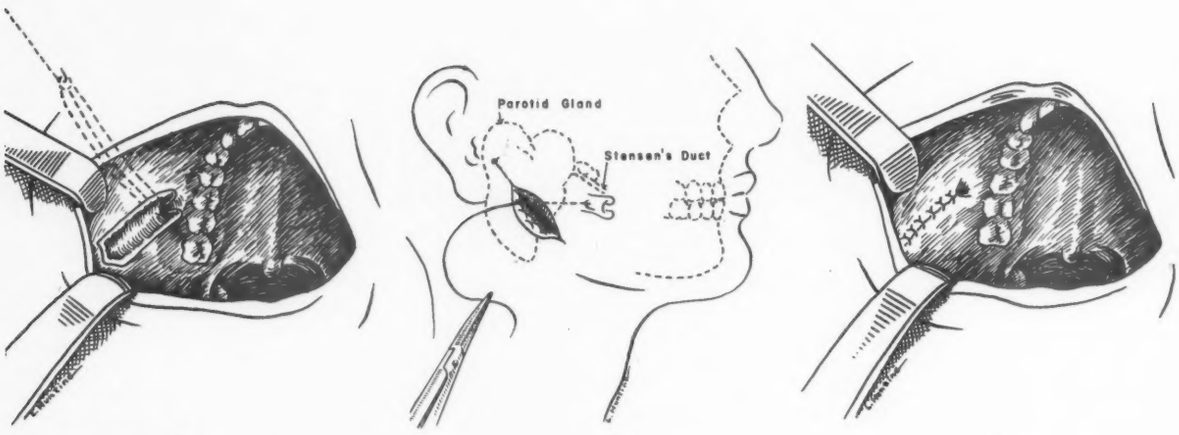


FIG. 1. Buccal mucous membrane pedicle graft elevated and threaded through the cheek.

FIG. 2. Graft pulled through cheek to the source of salivary fistula.

FIG. 3. Intraoral opening of new duct.

Patient A. D. (Fig. 4) was slashed by a knife in the cheek which was deep enough to sever a secondary duct, although this was not recognized at the time of primary closure in the emergency ward. A swelling developed in the cheek that was fluctuant and tender. Aspiration produced a fluid that was thick and greyish in color. A direct mucous membrane pedicle flap was elevated and threaded through the cheek. Its distal end was sutured into the cyst-like cavity. Saliva continues to flow after five years without evidence of stricture or infection.

Mrs. K (Figs. 5 through 8) was seen with a swollen parotid gland that was very painful to palpation. Swelling would occur at mealtimes, but the gland would never return to normal size. She had had two previous operations in an attempt to re-establish continuity of the duct system. There was no history of stone. An incision was made in the cheek and the main duct was isolated. A stricture was found about 2 cm. proximal to the oral opening by probe. The dilated duct was severed. A pedicle flap of mucous membrane was

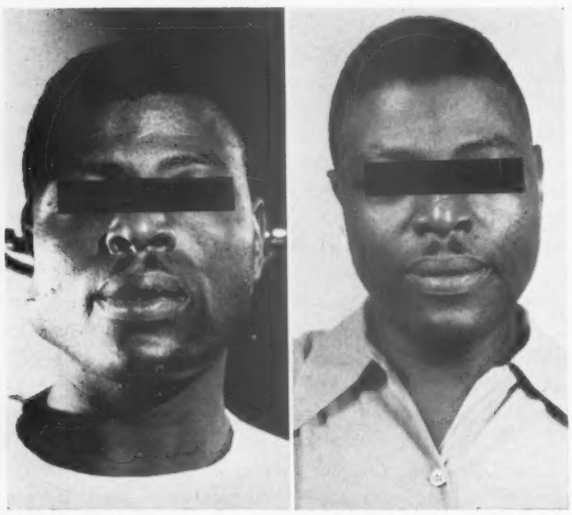


FIG. 4. Salivary cyst of cheek from knife wound corrected with buccal mucous membrane pedicle graft. (From: KIEHN, C. L. [4].)

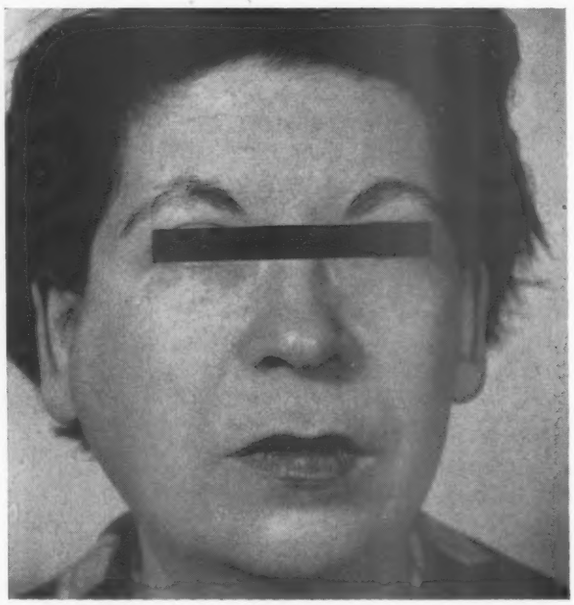
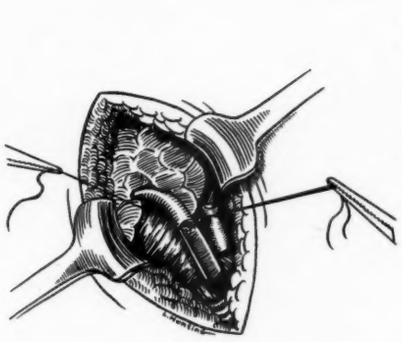


FIG. 5. Swollen and painful gland due to cicatricial atresia of main duct.



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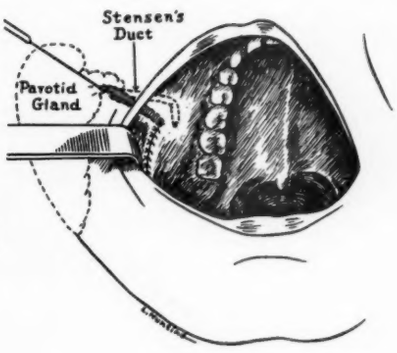

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FIG. 6. Graft sutured to duct whose distal end has been tied off.

FIG. 7. Relationship of graft to old duct.

elevated from the cheek and threaded through the buccal tissue to the duct. It was then sutured to the duct without tubing. A probe could easily be passed from the mouth into the duct. The incisions were closed and the wound healed normally. She has had no symptoms referable to the parotid gland for over two years.

Mr. Y. (Figs. 9 and 10) had a small parotid tumor removed from the left gland. Palsy developed, as did a fistula which would not heal. The fistula was treated by placing a pedicle flap of mucous membrane into the fistulous tract. The tract was excised and closed. The face was then threaded with fascial stips to correct the sagging cheek.

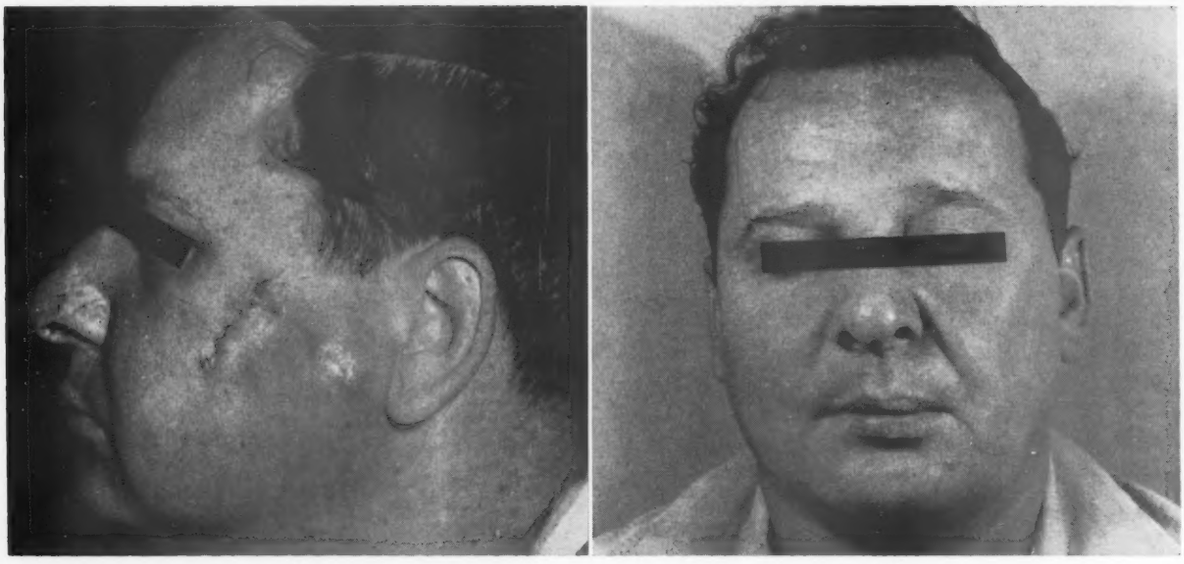
Mrs. B. (Figs. 11 and 12) was thrown through a windshield and sustained severe lacerations of the face. A complete facial palsy and a postauricular salivary fistula developed just anterior to the mastoid process. Through a scar in the face the entire facial nerve was isolated from the dense fibrous tissue. There was immediate improvement in facial function following this procedure. At the same time dense fibrous tissue was encountered around the macerated ducts. The largest identifiable branch was sutured to a previously prepared mucous membrane pedicle flap. One year following the duct by-pass the fistulous tract in the postauricular area had healed.

Mr. A. B. (Figs. 13 and 14) was in an automobile accident and had a piece of his cheek avulsed, including the distal parotid duct system. We were presented with the problem of reconstruction of the duct system and closure of a cheek defect. The duct was dissected and a pedicle flap of mucosa was sutured to it. The cheek defect was

FIG. 8. Postoperative result of sutured graft to proximal duct. There was no recurrence of parotiditis.

closed with a large rotation pedicle graft from the inframandibular region. This healed without complications. A catheter was placed in the reconstructed duct for maintenance of the lumen. This was discontinued in our later cases as unnecessary.

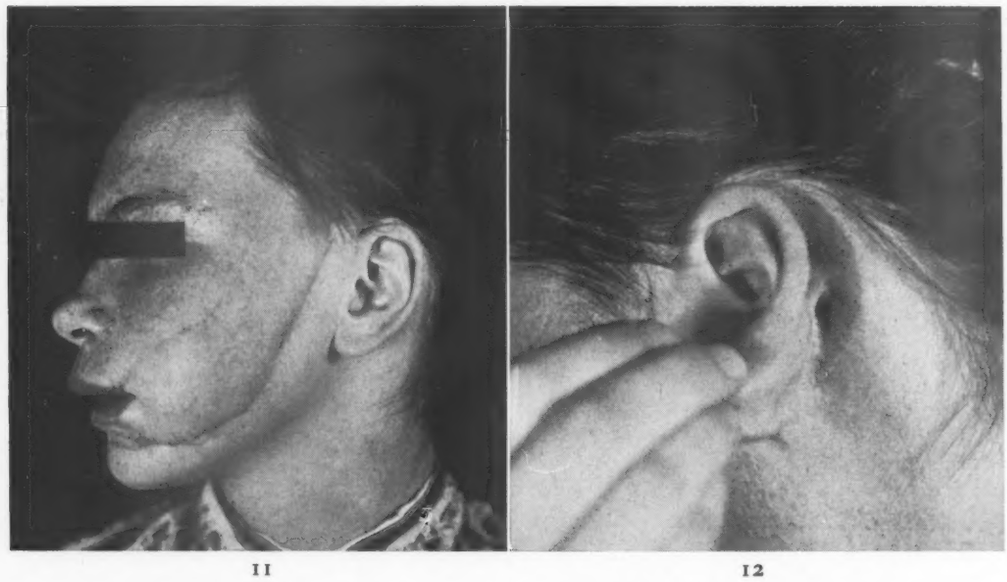
These several representative cases from a group of ten demonstrate the by-pass operation for salivary flow. We believe it is a simple procedure that does not require tubing the pedicle, provides for an epithelial-lined canal into the mouth and does not need periodic soundings for maintenance of caliber of the canalized cheek. A stricture has not developed



9 10

FIG. 9. Residual fistula and cyst following removal of parotid tumor.

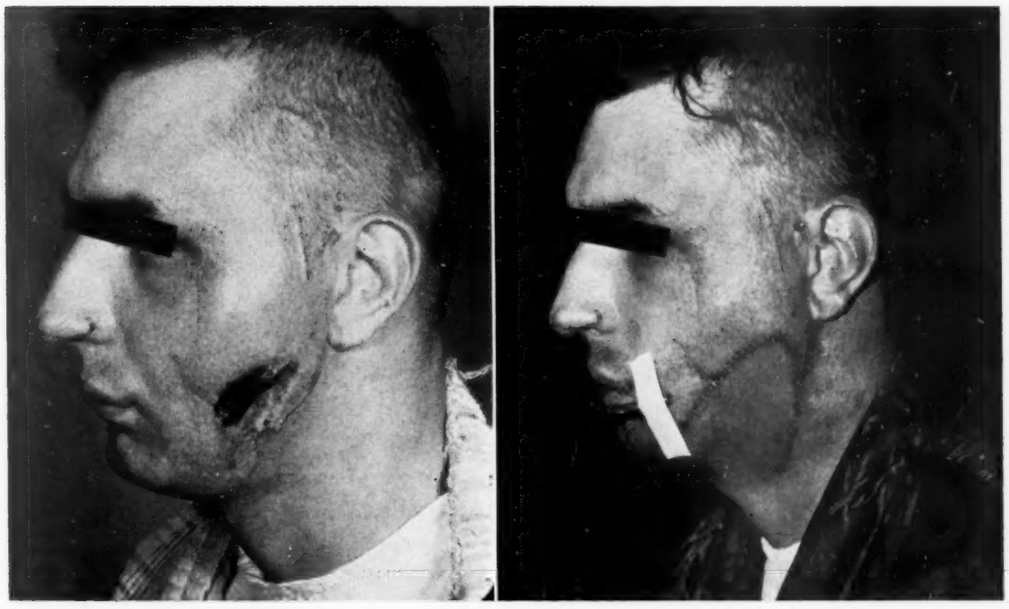
FIG. 10. Graft sutured in the vicinity of fistulous tract with complete healing.



11 12

FIG. 11. Complete facial nerve palsy and severance of parotid duct from windshield injury.

FIG. 12. Unusual postauricular fistulous opening following windshield injury. Drop of saliva seen in auriculocephalic angle.



13 14

FIG. 13. Avulsed cheek and parotid duct with cutaneous salivary fistula.

FIG. 14. Defect closed with rotation flap and normal salivary flow restored with mucous membrane pedicle graft.

in any of these patients nor has there been any evidence of retrograde infection from the mouth.

CONCLUSIONS

A one-stage operation for the correction of persistent salivary fistula of the parotid gland has been described. It will be successful if the principles of pedicle design and atraumatic® handling of tissue are not violated. This procedure should be performed primarily if the diagnosis can be made. The pedicle need not be tubed nor a catheter inserted into the duct system to maintain patency.

We also advocate the installation of methylene blue in the duct system, as used by Robinson [5], to aid in the dissection for the preservation of the facial nerve.

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Vitallium Implant for Transected Portion of the Mandible

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REMOVAL of segments of the mandible may be a prerequisite for the best possible prognosis in the treatment of tumors of the mandible and adjacent structures, but the consequent structural and functional results are quite unsatisfactory. The usual drifting of the residual segment of the mandible, upward, inward and backward, produces a poorly functioning masticatory apparatus and is disfiguring. During the past few wars considerable experience has been gained in the management and restoration of loss of portions of the mandible due to trauma. All of these procedures are time-consuming, require staged operations and are economically unfeasible for the average civilian patient.

It is advisable in patients with cancer, in view of the foreshortened life expectancy, to attempt early reconstruction of the lost part. Delay makes the patient less acceptable to people in his normal environment. Early reconstruction and the return of the patient to a normal existence in the shortest possible time is a goal we strive to attain. The ideal time for reconstruction and anatomical restoration for normal physiological function is at the time of the original surgery, and before soft tissue collapse and contractures have occurred.

Many papers have been written demonstrating technics using different materials in attempts to overcome the problems incidental to delayed restoration of the transected mandible. The success of the technics has been as varied as the materials used. Bone, autogenous and homologous, Vitallium,® steel and the inert plastics are some of the materials in use at this time. There is no doubt that in carefully selected cases autogenous bone would give uniformly satisfactory results, yet considering the fact that living bone requires a well vascularized bed virtually free from contamination for "take" of the graft, only a small number of cases ideally lend themselves to this method. When radiation has been resorted to prior to surgery, or is contemplated following surgery, the viability of the autogenous graft may be seriously compromised. In these cases a high incidence of delayed resorption and extrusion of the graft has been observed. Furthermore, if surgery requires the removal of the head of the condyle, restoration of that part by autogenous bone is more difficult and less apt to be successful.

The use of Vitallium to replace transected portions of the mandible has been described by Conley, Winter and others. A variety of implants are available. In the dentulous patient the problem of attachment of the prosthesis to the remaining bone presents difficulties if buccal and lingual flanges are used. The insertion of screws to attach these flanges may result in penetration of the screws into tooth structure. These screws usually exfoliate in a relatively short time. In the edentulous patient these flanged prostheses may be used more successfully, providing the curve of the flange is congruous with the curvature of the residual mandible.

We prefer the following technic. A lateral x-ray film of the mandible can be utilized to determine bone height and length, and a basal view of the skull can be utilized to determine mandibular curvature. Caliper measurements from the head of the condyle to the inferior border of the mandible at the site of contemplated transection are taken. These can be checked with the x-ray film. The head of the condyle can be located 11 to 13 mm. in front of the tragus on the tragus-canthus line. The height of the mandible at the site of transection can be accurately measured

using sharpened "outside" calipers with the sites of contact anesthetized by local anesthesia.

Utilizing the curve of the mandible obtained from the basal x-ray film and measurements obtained with the calipers, a wax template can be contoured to size. The height of the mandibular template can be reduced 30 to 40 per cent but left about the measured height at the point of attachment. If the coronoid process is in the portion of the mandible to be removed, it should not be incorporated into the prosthesis. A reduced wedge-shaped tenon is then added ahead of the proximal end of the prosthesis. This will eventually be impacted into the cancellous portion of the remaining mandible. Three holes are drilled vertically about 3 to 4 mm. posterior to the end of the implant. An appreciable bulk of the wax template can now be removed by drilling large holes in the body of the prosthesis. This is then processed in Vitallium.

Following the removal of the involved portion of the mandible, the prosthesis is brought into place. The head of the condyle is fitted into position in the glenoid fossa by suturing the capsular ligaments and residual external pterygoid muscle about the neck. The small tenon is now impacted into the cancellous portion of the bone. Holes are drilled in the proximal end of the mandible in line with the holes in the prosthesis. Twenty-eight gauge stainless steel wire is used to fix the implant in position. The masseter and internal pterygoid muscles are then sutured to the prosthesis. Closure is made over the implant in the conventional manner. Intermaxillary fixation is used to maintain the residual mandible in correct position and to minimize drift to the affected side.

The use of inert, non-organic implants for replacement in cases of mandibular transection has a definite place in the armamentarium of the maxillofacial surgeon. Further investigation of materials and technics should be a rewarding endeavor. Too often intraoral prosthetic restoration in cases of mandibular loss presents problems which could be more readily solved if consideration to immediate reconstruction had been undertaken. The surgeon and the maxillofacial prosthodontist can act as a team for the treatment and rehabilitation of the patient with cancer of the head and neck. The use of implants to replace the resected mandible is one phase of this cooperation. An ideal example of the use of this type of restoration is the following case of mandibular resection, including the condyle, for an ameloblastoma.

CASE REPORT

Miss I. O., a twenty-four year old schoolteacher, was well until twenty months prior to surgery, at which time she noted enlarged right submaxillary lymph nodes. She went to her local physician who found nothing abnormal on physical examination. Four months later she went to her local dentist who, on intraoral x-ray of the right mandibular molar teeth, discovered a multiloculated radiolucency of the mandible. In January, 1957, she was referred to an oral surgeon. Biopsy proved the lesion was an ameloblastoma. The entire area was curetted and packed with gauze. This was gradually removed over a six-week period after which time the mucosa and mandible were apparently fully healed. Some evidence of recurrence was noted in October, 1957, but no external growth was noted until March, 1958, when the right side of the mandible began to enlarge. (Fig. 1.) A Vitallium implant was made according to the described technic and on April 1, 1958, the patient was operated upon.

A right submaxillary incision was made and the mandibular branch of the facial nerve was located and retracted. Several firm submaxillary nodes were dissected free from the salivary gland and left attached to the lower border of the mandible. The mandibular first bicuspid was removed and the mandible transected at this point. An incision was made through the mucous membrane of the mouth on both sides of the gingiva, and the mandible was dissected free, transecting the masseter, internal pterygoid and temporal muscles. The entire mandible was freed up to its neck, and the external pterygoid muscle was transected. The capsule of the temporomandibular joint was

FIG. 1. X-ray of mandible showing extent of lesion.

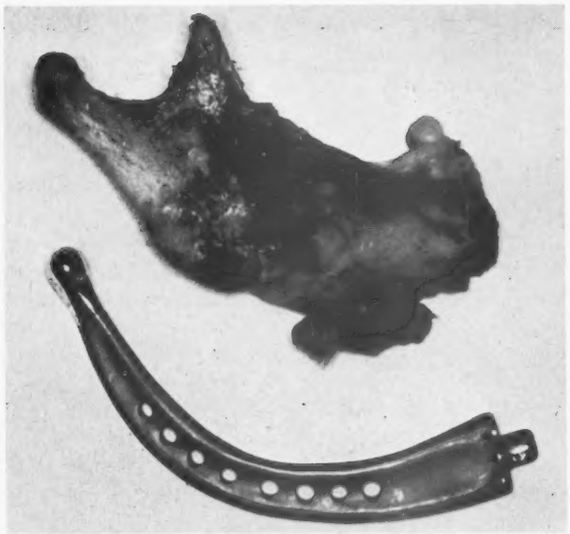

FIG. 2. Resected mandible with Vitallium replacement.

FIG. 4. Postoperative view of patient.

incised and dissected as a cuff, freeing the head of the condyle. The mandible with the attached submaxillary lymph nodes and gingival mucosa was removed. (Fig. 2.) The mucous membrane of the mouth was sutured, completely closing the oral cavity from the wound. The head of the Vitallium implant was inserted into the glenoid fossa, and the cuff of the joint capsule was sutured about it. The other end of the implant was inserted into the marrow of the mandible in the first bicuspid area, and three holes were drilled through the cortex of the mandible. The implant was fixed to the bone by three No. 28 gauge steel wires. The center was threaded through the hole in the extension inserted into the marrow cavity of the mandible. The cut masseter and internal pterygoid muscles were then sutured to the implant. The wound was closed in layers without drainage and a pressure dressing was applied. (Fig. 3.) Intermaxillary fixation was instituted

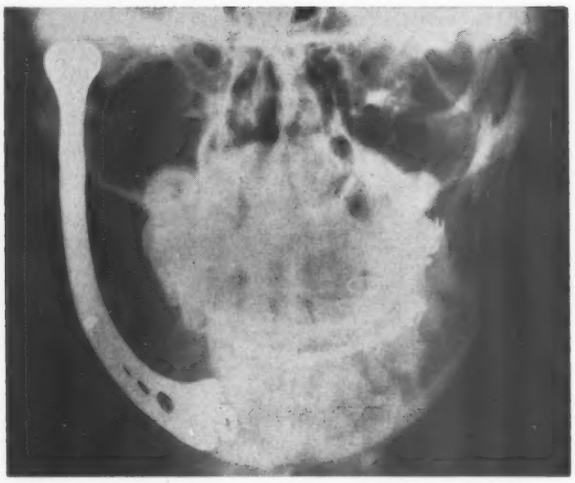

FIG. 3. Vitallium replacement of the mandible.

the following day using arch wires. The patient was given penicillin and streptomycin postoperatively. Her postoperative course was entirely uneventful and she was discharged on the fifth postoperative day. The resultant cosmetic and functional result was excellent. (Fig. 4.) The pathologic report, as expected, was ameloblastoma and hyperplastic lymph nodes.

SUMMARY

Early reconstruction is indicated in surgery of the mandible. This is an aid in preventing deformities and scar contracture. A technic is presented using a preformed, specially constructed Vitallium prosthesis which is inserted at the time of the surgical resection. This is particularly indicated in cases in which the head of the condyle is to be removed.

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Induced Regression of Neoplasms by the Controlled Limitation of Vascular Supply

A METHOD FOR THE REMOVAL OF SOME TUMOR GROWTHS WITH IMPLICATIONS OF CERTAIN BENEFICIAL EFFECTS

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THE fact that the growth and viability of any tissue, whether normal or neoplastic, depends upon an adequate blood and lymph supply is obvious.

The concept that a neoplastic tumor requires a good blood supply from its host for nutrition and continued growth is generally acceptable [1].

Just as the fruit on the vine will wither and fall away if the trunk is cut, so will tissue cells and parts of the body undergo inactivation of growth, atrophy and exfoliation if the circulation to the area is interrupted. Therefore, it is logical to consider that restriction of the vascular supply of a tumor would interrupt its development, lead to atrophy, and result in an induced regression [2]. Moreover, evidence is at hand that such gradual progressive destruction of the tumor growth, caused by strangulation of the blood supply, produces antigens which may provoke an immune-body response [3]. Thus, in animals, it has been demonstrated that by this procedure an immunity can be produced, which will protect against reinoculation with other tumor implants, and which will cause a resolution of established metastases [4].

Any process that results in or produces interruption of the vascular nutrition will lead to ischemia and anemic atrophy.

A number of methods which result in some degree of occlusion of the essential vascular supply may be mentioned, e.g., (1) surgical: occlusive ligation of vessels, tourniquet strangulation of tissue; (2) thermal: destruction and sclerosis, diathermy and cautery; (3) chemical: chemocautery (Kahlenberg), destruction and sclerosis; (4) radiation: selective action and obliterative sclerosis; (5) inflammatory: infection, Coley's serum followed by fibrosis; and (6) sclerosing solutions: fibroblastic proliferation and fibrosis.

Our experience, which we wish to describe, has been mainly with the application of an elastic constriction or tourniquet device which affords a positive, controlled surgical procedure. This method of producing induced regression of tumor growth by the application of controlled progressive restriction of the vascular supply has been developed, and used with encouraging results.

While this paper is primarily concerned with the topic of induced regression of tumors, it is pertinent to examine its relationship to the subject of spontaneous regression.

An increasing interest is evident in this unusual and atypical pattern of tumor growth. Generally the natural history of a malignant neoplasm can be predicted on the clinical and histological characteristics. It is ordinarily expected that a proved cancerous tumor will follow a relentless course of invasion and metastases unless it is completely extirpated by surgery, radiation or other therapy.

The unremitting qualities of cancer development are so constantly evident, that one must be imbued with a considerable degree of temerity to entertain the thought that tissue resistance and/or immune body reaction can be effective factors in controlling or eliminating a cancerous process.

There do exist substantiated examples of spontaneous regression and prolonged abeyance

and continued arrest. These rare cases, if examined carefully, give hope of arriving at an understanding of malignant tissue growth that could eventually lead to a better conception of pathogenesis, and thus a better application of therapy. This prospect sheds a glimmer of hope on an otherwise depressing picture, and stimulates both a feeling of excitement and one of sober awe.

Numerous statements in the literature have referred to examples of such unusual and unexpected behavior of tumor growth. Boyd [*5*] has collected thirty-nine case histories which survived his selective criteria for qualifying as examples of spontaneous regression. In most instances, histological studies substantiated the clinical findings, and therapy was not a factor in altering the course. He stated that changes in the environment of a cancer growth resulted in changes in the cancer cell. He theorized that an immune mechanism could be a force in changing the environment.

Everson and Cole [*6*] have accepted the thought that spontaneous regression may offer a ray of encouragement to an otherwise hopeless victim of cancer. Cole [*7*] has also proposed the procedure of decreasing the vascular supply to an affected bowel area by ligating the major vessels, in the hope of limiting the spread of the tumor.

Strauss [*8,9*] has recently stressed that destructive procedures, such as electrocoagulation, not only remove the neoplastic mass, but that the by-product produced by the necrosing process may stimulate an immune response which seems to inhibit recurrences.

Lewis and Aptekman [*4*] have shown that decreasing the blood supply of tumors in rats, by moderate constriction with tourniquet, not only inactivated the growth but caused an immune response which prevented reinoculation and produced a resolution of established metastases. Their work was with a certain species of animal, and concerned a specific variety of neoplasm. Whether or not similar results could be obtained in the human being with the usual varieties of human cancer is yet to be determined.

The effects of radiation therapy on malignant neoplasm are not only cancerocidal, often in quite a selective degree, but also obliterative to the blood supply by producing subsequent fibrosis.

There is good reason to believe that in cases in which tumor regression has followed acute infections or suppuration, or tissue destruction (such as induced by the use of toxins, e.g. Coley's fluid) a similar end result has been obtained, namely, obliteration of the vascular supply to the tumor area by the consequent fibrosis.

Rigdon [*10*] believes that local accumulations of lymphocytes within the tumor produce vascular obstruction and ischemia of the malignant tissue; and also that there may be immunologic factors influencing dissolution.

Injections of sclerosing agents placed at or beyond the base of some tumors (e.g. hemangiomas) will cause a similar end result by stimulating the production of fibroblastic proliferation and sclerosis.

Our interest in this fascinating subject dates back to about 1932. At that time, Dr. Carroll Birch [*11*] was engaged in her well known study of a large group of persons with hemophilia. Infected teeth, having a harmful effect on their arthritic condition, should have been extracted, but the severe bleeding tendency was a contraindication to ordinary surgical exodontia.

It was then found [*12*] that strangulation of the blood supply and pressure atrophy of the root attachment (periodontal membrane and alveolar bone) could easily be accomplished by the proper application of elastic constriction. This has become a recognized modality when properly applied in indicated situations. The offending organ (infected tooth) was exfoliated with no bleeding despite the prolonged delay in coagulation time. Thus removal was accomplished in, what might be termed, a "bloodless manner."

Dalitsch [*13*] stated in 1934 that the same procedure was of value in the removal of certain tumor growths and undesirable appendages. Maxeiner [*14*] has used elastic tubing to produce tourniquet amputation of an extremity. In our hospital (Research and Educational Hospital of the University of Illinois) amputation of the excessive digits in newborns afflicted with polydactylism has been accomplished by similar application of constrictive ligature.

Removal of undesirable organs and appendages from animals by such elastic constriction is a recognized procedure in animal husbandry. Its use is preferred to surgery by

many veterinarians. Thus, castration is performed in a clean, bloodless and efficient manner. The docking of sheep's tails is likewise successfully accomplished by tourniquet.

Clinical application of this *modus operandi* for the removal of tumors in man has yielded encouraging results. By various modifications of technic, elastic constriction was applied to the tissues at the base of tumors. Tightening of the constricting apparatus produced progressive limitation of the vascular supply. By proper regulation of the degree of constriction and strangulation, an anemic, dry, shriveling atrophy with mummification resulted. Sloughing, necrosis, infection and ulceration were minimal.

The "drawing together" of adjacent skin or mucous membrane towards a center stem or pedicle tended to minimize the extent of denuded or "raw" base that might remain when the tumor mass finally exfoliated. Then there was no need to provide for a surface covering to the remaining defect, if any.

The "bloodless" and usually painless course of the exfoliation process, and the conservative sacrifice of tissue substance as compared with surgical management, are advantages.

It should be noted that a tight tourniquet caused rapid strangulation, but interfered with the development of an immune type of resistance [*4*].

Also, it has been found that tourniquet occlusion of the blood supply had a relatively selective effect in that it produced greater damage to malignant tissue than to the normal cells enclosed in the tourniquet [*15,16*].

CASE REPORTS

Case I. J. M., an eighty-three year old man, entered the Cook County Hospital in November 1956 complaining of a large tumor growth on the face. Examination disclosed a rounded mass in the skin over the right malar region about 2.5 by 2.5 cm. The center of the mass was slightly ulcerated. No enlarged lymph nodes were palpated. There were present in scattered distribution over the skin of the face, numerous smaller lesions which appeared to be basal cell skin cancers. (Fig. 1.)

Biopsy specimen of the large tumor showed epidermoid carcinoma.

Using procaine block anesthesia, the tissue substance under the base of the growth was transfixed with three Kirschner wires. These were inserted in a cross pattern well down below the base of the lesion and through the unaffected tissue. Then a constricting elastic ligature was placed around the base of the tumor being fixed in place by the protruding ends of the transfixing wires. Thus the elastic ligature was prevented from migrating up onto the tumor as the constriction progressed. (Fig. 2.)

The ligature was drawn progressively tighter at two-day intervals. The tumor mass became smaller, paler and shriveled. (Fig. 3.) A dry type of atrophic gangrene resulted. (Fig. 4.) Complete exfoliation of the mass occurred two weeks later, leaving a smooth pink epithelium-covered base. This soon assumed a normal skin appearance with little or no discernible scarring. Later observation revealed no recurrence, no metastases and apparent regression of the other basal cell foci. This improvement however may have been influenced by better hygiene and skin care.

Case II. J. S., an obese white woman, forty-seven years of age, was seen with numerous lesions on the skin of the face. Several similar lesions had been removed by excision and by cautery, leaving rather prominent crater-like scars. Radiation had been applied over the nasal surface resulting in characteristic radiation dermatitis and atrophy. A biopsy specimen revealed basal cell carcinoma.

Under general anesthesia, a large lesion over the right temple was elevated with tenaculum traction, and three long quarter-circle needles were inserted in a crisscross pattern, placed well below the base

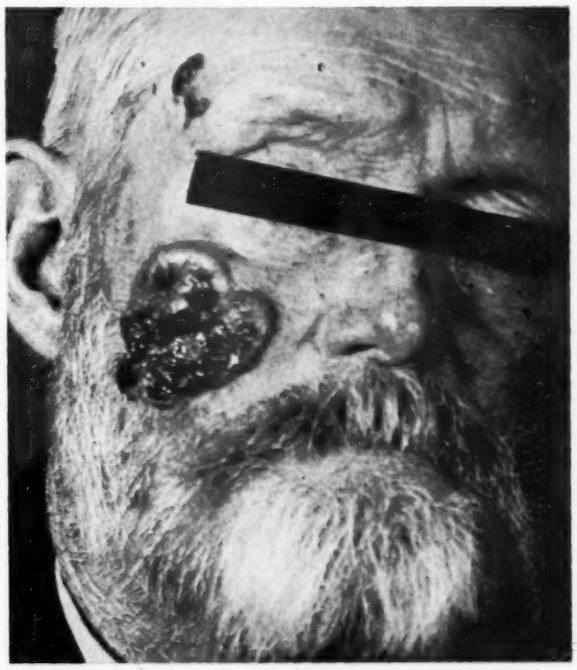

Fig. 1. Multicentric areas of basal cell skin cancer with one larger ulcerating epidermoid lesion.

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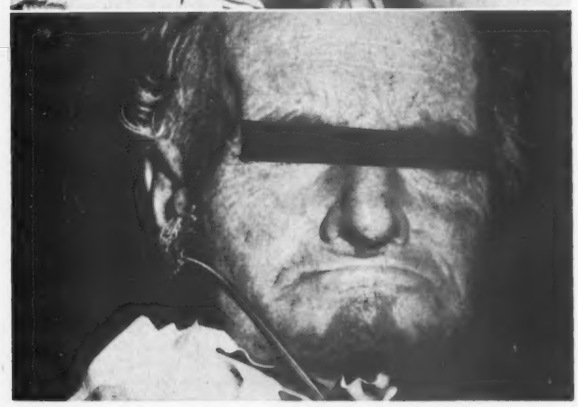

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FIG. 2. Skin cancer of epidermoid type undergoing atrophic regression induced by strangulation of vascular supply. Tissues below base of lesion has been transfixed by three pins placed in a crossing pattern. Elastic ligature tied under projecting pin ends exerts a continuous and progressive constriction.

FIG. 3. Further progress in separation of tumor as seen one week later.

FIG. 4. Exfoliation of tumor almost accomplished. Only a thin avascular pedicle attaches mass. After removal was completed, remaining site was clean with no bleeding, uneventful healing and minimal scar.

of the lesion and through normal tissue. Elastic bands were applied between the skin surface and the protruding needle shafts. Constriction was maintained for eight days. The lesion underwent a dry atrophic regression and was exfoliated at the end of that time, leaving a small pink base which was less noticeable than other areas where excision had been used.

CASE III. A. D., a white woman fifty-two years of age, presented with an elevated and slightly ulcerated mass in the posterior area of the lower right alveolar ridge. The tumor was about 1 cm. long and .5 cm. wide and somewhat pedunculated. A biopsy specimen disclosed squamous cell carcinoma. The patient was edentulous and the edge of the artificial denture appeared to be irritating the gum in the area of the growth.

A constricting purse-string elastic suture was placed around and below the base of the tumor. This was progressively tightened. The growth became shrunken in size and exfoliated in ten days, leaving a smooth, non-bleeding base, which healed without incident. Subsequent check-up revealed no recurrence and no metastases.

COMMENT

While not many patients have been treated by this method, nor has there been a sufficient time lapse to draw positive conclusions, there is evidence that the experimental results obtained in laboratory animals may be achieved clinically in man. If there is a possibility that this method of tumor removal does stimulate the production of an immune response resulting in a decreased tendency to recurrence and metastases, then the value of this procedure deserves thorough investigation.

SUMMARY

The concept that a cancerous growth depends upon its host for its blood supply seems generally acceptable [*12*]. Therefore, it is reasonable to consider that interruption of the vascular supply of a tumor would interfere with its growth and possibly lead to regression and atrophy of the neoplasm.

Evidence points to the possibility that at times regressive changes might be favorably influenced by some complex form of local or general immunity [*13*].

In animals, immunity can be elicited by slow destruction of a tumor implant. This could be explained by antigen formation resulting from the destructive tumor process.

A method of producing controlled tumor destruction by the gradual limitation of its blood supply has been accomplished clinically with encouraging results that warrant further investigation.

Further research in the clinical application and in the laboratory aspects is under way. Inquiry into the biochemical, immune body, and metabolic changes produced is in progress.

Spontaneous regression of tumor growth has been reported in a number of substantiated instances.

Induced regression has been accomplished in animals and in man.

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Branchiogenic Cyst Carcinoma

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PRIMARY carcinoma of the neck of residual branchiogenic origin was first described by Von Volkmann in 1882 [1]. His observations depended on the presence of carcinoma in the neck with no obvious evidence of a primary lesion in the mouth or nasopharynx as determined by simple examination and finger palpation.

During the seventy-six years since the publication of Von Volkmann's paper, many studies have been made either to prove or disprove his original observations. We believe that there is such an entity but that it is not a common occurrence and that certain strict criteria for the diagnosis should be satisfied.

The first dissenting opinion came from Sutton in 1893 [2]. He doubted the occurrence of branchiogenic carcinoma and wrote "A good deal has been written about 'branchiogenic cancer,' or, as it is sometimes called 'malignant cyst' of the neck. . . . Some writers are of opinion that these are primary epitheliomata, arising in remnants of branchial clefts. My belief is that, in most of the cases, these gland masses are secondary to epitheliomata originating in recesses of the pharynx or naso-pharynx, and the theory that they arise in remnants of branchial clefts is pure fiction."

A mass in the neck suspected of being carcinomatous should be investigated by careful examination of the oral cavity and pharynx, nasopharynx, larynx and cervical esophagus, thyroid, salivary glands and study of the sinuses and chest. Beyond that some clinics use aspiration biopsy and, if epidermoid carcinoma is found, advise neck dissection if the lesion is more than 3 or 4 cm. in diameter, or radiotherapy if the lesions are smaller. Meanwhile there is continued searching for the primary site [3]. Others believe the treatment is radical neck dissection and radiation to the nasopharynx.

Crile and Kearns [4] in 1935 reported twenty-eight cases of alleged branchiogenic carcinoma, in none of which did the patient survive five years. The authors believe that branchiogenic carcinoma is resistant to roentgen therapy. Oliver [5], writing from Johns Hopkins, believes that the site of embryologic origin may be obscured by invasion of the carcinoma.

Jones, Snyder, and Dowlen [6] in their review reported a possible case and advised radical neck dissection and postoperative radiation in cases of malignancy of branchiogenic origin. They also discussed the embryologic background of the disease.

Ward, Hendrick and Chambers [7], in a review of branchiogenic anomalies at Johns Hopkins Hospital, found seven of seventy cases to be carcinoma. However, even with simple criteria most of these cases can be eliminated and only two or three are left. These may be the same cases reported by Oliver from the same institution. Ward et al. believe the prognosis is poor as the lesions are undifferentiated and the patients present themselves late.

Willis in 1934 [8] believed that branchiogenic cancer should be "tolerated neither as a clinical diagnosis nor as a histologic finding on surgical material." Brown and McDowell [9] believe that the existence of branchiocarcinoma is open to question but the clinical picture will be seen. They believe that radiation to the nasopharynx can be employed routinely.

In 1955 Conway and Jerome [10], in a review of ninety cases of bronchiogenic cleft cyst, found no carcinoma and wrote, "The earlier teaching that malignant tumors originate frequently in branchial anomalies is not substantiated by the review."

Martin, Morfit and Ehrlich [3] state: "The longer we consider the proposition the less confidence we have in the existence of an

entity which warrants the specific name 'branchiogenic cancer.' The only absolute proof of the existence of a specific tumor such as branchiogenic cancer would be the histologic demonstration of cancer arising in the wall of a branchiogenic cyst; so far as is known no well-documented case of this kind has ever been recorded." These authors have surveyed the literature on malignant branchioma up to 1950 and have found 225 to 250 cases recorded by thirty-four authors. Of the total cases, "It is not possible to accept more than three as presenting reasonable evidence of branchiogenic origin as judged by the diagnostic criteria at the Head and Neck Clinic at Memorial Hospital." These are three of Olivers' eighty cases reported in 1935, and may be the same cases reported by Ward et al. from the same institution. The criteria followed by Martin et al. are: (1) location along the anterior border of the sternocleidomastoid muscle; (2) histologically consistent with tissue present in branchial vestigia; (3) patient has survived five years with no other primary site appearing; (4) histologic demonstration of carcinoma in a lateral epithelial cyst. These workers report that of 5,000 new cases seen from 1933 to 1940 only fifteen or 0.3 per cent were tentatively diagnosed as branchiogenic carcinoma, but inasmuch as these lesions were treated by radiotherapy, a possible primary lesion may also have been included in the field. In their summary they stated their belief that the existence of branchiogenic carcinoma as a clinical entity is hypothetical. The diagnosis cannot be made histologically and the diagnosis is tentative until there is five-year survival without the discovery of another primary site.

In view of the two cases to be presented in this report I believe that there should be a modification of these criteria. The most important criterion should be the histologic demonstration of carcinoma in a branchiogenic cyst. If the lesion can be demonstrated histologically, there can be no doubt about the diagnosis. The other criteria should be secondary and apply in cases in which histologic proof cannot be demonstrated. In order to prove the lesion histologically, it is necessary to remove the entire lesion either by local resection or radical neck dissection. Aspiration biopsy cannot prove the diagnosis. If desired, radical neck dissection can be performed at the same time, after frozen section, or can be performed subsequently. In some cases the local resection can be followed by radiotherapy depending on the findings and conditions in each individual case.

CASE REPORTS

CASE 1. L. A. was a sixty-four year old white man who first noted a mass in the right upper part of the neck in January, 1957. The mass was located anterior to the sternocleidomastoid muscle. It grew for three weeks and fluctuated in size before the patient sought medical care. No abnormalities were found on complete investigation of the oral cavity, pharynx and nasopharynx, larynx and sinuses. The patient was admitted to the hospital in January, 1957, and the complete lesion was removed. The mass was 5 by 3 cm. in size and was located between the angle of the mandible and the sternocleidomastoid muscle, just lateral to, and attached to, the internal jugular vein. It was partly cystic and partly solid, and was well encapsulated. On histologic study the mass proved to be a branchiogenic cyst with squamous cell epithelioma originating in a portion of the wall. (Fig. 1.) The lesion was removed entirely and at no point was there any suspicion of residual disease, but a radical neck dissection was performed. No additional tumor was found in the removed tissue and the postoperative course and healing were uneventful, with the patient being discharged on the sixth day. There

FIG. 1. Case 1. Pathologic specimen, cut surface, showing branchiogenic cyst with carcinoma arising in the wall.

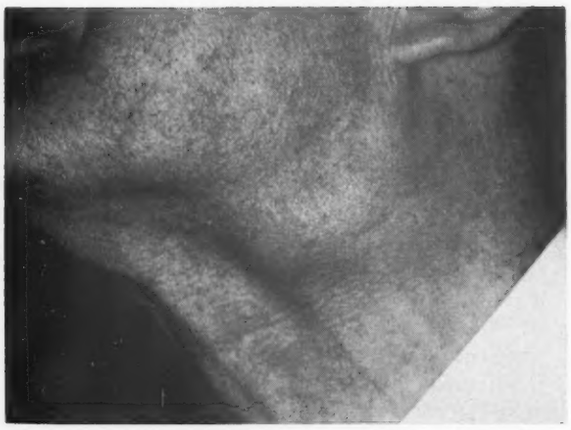

FIG. 2. Case II. Lateral view of patient's neck showing location of mass.

FIG. 3. Case II. Pathologic specimen, cut surface, showing branchiogenic cyst with carcinoma arising in the wall.

have been no signs of recurrence or evidence of any additional disease until the present time.

CASE II. S. S. was a sixty-four year old man who in April, 1957, noticed a swelling in the left upper part of the neck located anterior to the sternocleidomastoid muscle, and between the angle of the mandible and the muscle. The swelling had grown in three weeks. (Fig. 2.) After complete investigation of possible primary sites, a partial neck dissection was performed, removing the entire mass and the internal jugular vein but preserving the sternocleidomastoid muscle. The mass was found to be attached deeply at the bifurcation of the carotid artery. The mass was found to be partly cystic and partly solid, and on histologic study proved to be a branchiogenic cyst with epidermoid carcinoma originating in part of the wall. (Fig. 3.) Healing was uneventful and postoperative radiotherapy was advised. Both 200 kv. x-ray and cobalt^{60} therapy were administered. However, the lesion recurred and continued to grow, necessitating the performance of complete radical neck dissection in January, 1958, nine months after the initial surgery. The tumor was found to be adherent to the wall of the common and internal carotid arteries. The major part of the mass was removed during the neck dissection, and several silver Cushing brain clips were placed about the site of adherent residual tumor. This area was used as a target for postoperative supervoltage therapy with cobalt^{60}. In May, 1958, several small masses developed in the left supraclavicular area, as well as an ulcer with a point of recurrent hemorrhage located just above the bifurcation of the carotid arteries.

SUMMARY

1. There is an entity called branchiogenic cyst carcinoma or malignant branchioma.

2. Certain diagnostic criteria have to be satisfied before the diagnosis can be substantiated. The most important criterion is histologic proof of both branchiogenic cyst and carcinoma in the same specimen.

3. Preoperative diagnosis and investigation should include complete examination of the oral cavity, pharynx and nasopharynx, larynx and cervical esophagus and the sinuses.

4. Treatment should consist of total removal preferably by radical neck dissection or use of radiotherapy after total removal if neck dissection is not performed.

5. Two histologically proved cases of branchiogenic cyst carcinoma are presented.

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Fibromyxochondrosarcoma of the Mandible

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The case reported herein, a rare tumor of the mandible, offered a challenge not only in the fields of diagnosis and pathology but also surgery and management.

CASE REPORT

The patient, a seventeen month old female infant, was first seen in August, 1953, when she was referred by her pediatrician. Progressive swelling of the left body of the mandible had been noted by her parents for the past two months. Her past history was of no significance and her growth and development had been normal.

Clinical examination revealed a swelling of the left body of the mandible which extended from the molar to the canine area. Examination of the oral cavity showed that the deciduous teeth of the left mandible had erupted prematurely and that there was marked bulging of the buccal and lingual plates. On palpation the area was spongy in character.

The child was admitted to the hospital and all laboratory data were found to be within normal limits. Roentgenograms revealed a tumor of the left body of the mandible in the form of a multilocular cystic lesion extending from the crest of the alveolar ridge to the inferior border of the mandible. (Fig. 1.)

A biopsy performed on August 29, 1953, was reported as a soft odontoma, which is supposedly a benign lesion.

The patient was discharged from the hospital on August 30, 1953, at the insistence of the parents. She was to be readmitted for further surgery, the type depending on the pathologic report.

Because of the report of a soft odontoma, it was decided to allow the oral wound from the biopsy to heal, and then approach the lesion externally through a wide submandibular incision and remove the tumor by thorough curettage without sacrificing the continuity of the body of the mandible.

Accordingly, the patient was readmitted to the hospital the following month and on September 25, 1953, the procedure outlined was performed. The lesion was completely enucleated by curettage to the peripheral margins of normal-appearing bone. In excising the lesion it was found necessary to perforate the oral mucous membrane, and all deciduous teeth and permanent tooth buds (lower right central incisor, lower left central and lateral incisors, canine, first and second premolar and first molar) in the area were removed. Following the operative procedure the patient was left with little more than the inferior border of the mandible for a considerable area. The operative wound was irrigated with normal saline, a Penrose drain was placed in the bone cavity and the wound was closed in layers.

Postoperatively the patient did very well. However, it was noted that the lymph node at the left angle of the mandible enlarged during the postoperative drainage period; this enlargement persisted. The pathologic report on the entire tumor was, as before, soft odontoma.

The patient was followed up in the office postoperatively. Five months later (March, 1954) a recurrence of the tumor was noted in the right body of the mandible. (Fig. 2.) The patient was readmitted to the hospital and on March 8, 1954, this lesion was treated by curettage through a

Fig. 1. X-ray of original swelling showing expansion and bony destruction of left mandible.

wide oral incision. X-rays of the left side taken at this time indicated bone regeneration. Surgery revealed the presence of about 2 inches of apparently normal bone at the symphysis between the site of previous surgery on the left side and the recurrence on the right side. It was wondered if the tumor on the right side might not be a separate entity, although this was believed to be quite improbable. The patient's postoperative course was uneventful and bone regeneration was noted in serial x-rays.

During this second operation all the permanent tooth buds in the area, as well as the deciduous teeth, were removed with the specimen. The pathologic report on this second specimen was again soft odontoma, and the microscopic appearance of the tumor was almost identical with that of the first tissue excised.

Eight months later (November, 1954), a recurrence was noted in the area of the left angle of the mandible. (Fig. 3.) On December 1, 1954, this was excised by curettage through an oral approach. This method of excision was used during the second and third operations, as the patient was followed up closely and the recurrences noted were of a size that could easily be handled from an oral approach. However, at this point it was thought that a radical procedure would be necessary to eradicate the lesion in spite of its supposedly benign nature. Therefore, it was questioned that the lesion was really benign. The chief pathologist at the hospital agreed that the clinical course of the tumor pointed to a malignancy, but held steadfast to his diagnosis of soft odontoma which appeared benign to him on microscopic examination, with all specimens almost identical on serial sections. However, he agreed to have pathologic consultations. Sections were sent to one pathologist who diagnosed the lesion as benign myxoma. Sections were also sent to two other pathologists who concurred with the diagnosis of benign soft odontoma.

At this point it was suggested to the parents that more radical surgery would probably be necessary in order to get beyond the lesion for an attempted cure. This suggestion was violently opposed by the parents. Therefore, consultations were called to see if our contention would be supported. The case was reviewed by the chief roentgenologist at the hospital who believed that radiation was not indicated due to the overlying cortical bone with the tumor spreading through the spongiosum. A general surgeon believed that the only chance of cure was complete excision of the entire mandible. The chief orthopedic surgeon and a maxillofacial surgeon both thought that more radical surgery should be performed and that excision of the mandible, with the exception of the small area of cortical bone at the inferior borders of the body of the mandible, was the procedure indicated.

The child's parents were made completely aware of these consultations in detail and of the seriousness of the problem, but they were not able to face the situation. They could only see that the child was always fine and did well following curettage and, therefore, desired that the recurrences be removed by curettage indefinitely. Furthermore, at this time they had called in their own consultant, a local chiropractor, who partially convinced them that chiropractic measures were the answer to the child's problem.

Following the third operation the child was again closely followed up. Five months later (April, 1955) it was apparent that a recurrence was present not only on the right side but also

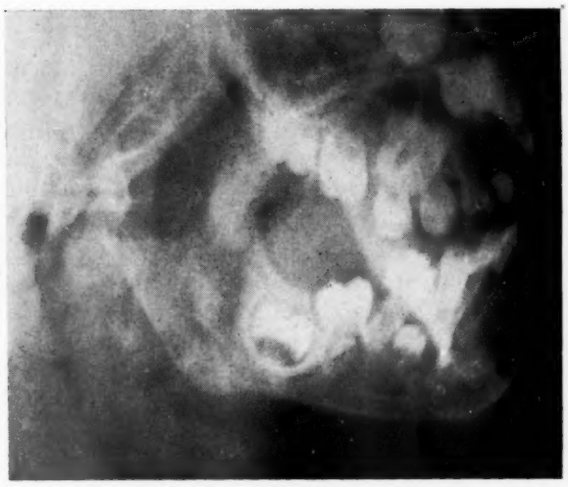

FIG. 2. X-ray of right mandible showing direct extension of tumor from left mandible.

FIG. 3. X-ray of mandible previous to bilateral radical dissection of upper neck and removal of recurrent tumor.

probably on the left. Radical excision was strongly advised but was refused by the parents as they were under the influence of the chiropractor at this time and also persisted in the belief that if the lesion were treated by curettage, eventually recurrences would become less frequent with a final cure resulting.

At their insistence, on April 20, 1955, the child was again operated upon with an incision made over the entire body of the mandible from the oral approach. Surgery revealed both right and left recurrences of the tumor and also that the tumor clinically extended throughout the spongiosum and that overlying areas of cortical bone which had appeared normal on x-ray were in reality undermined by tumor tissue in the underlying spongiosum.

Again the pathologic report was soft odontoma, but this time the pathologist was brave enough to add to his report that in view of the many recurrences the tumor should be considered malignant. At this point the parents were informed that there would be no further excisions of the tumor by curettage and that it was believed only complete excision of the mandible would result in a cure. The parents were advised to consult the surgeon seen previously to see if he still believed that a fragment of the mandible could be salvaged in view of the present findings. The advice was not taken and again the patient was followed up postoperatively.

Six months later (October, 1955) recurrences were apparent in the left anterior and right angle areas of the mandible. Further surgery was urged by the parents, but permission for a radical procedure was denied. They then started looking for another surgeon to whom they could dictate the operative procedure they desired. Their family physician came to the rescue and recommended a surgeon at another institution to whom a full report of the case as reported was sent. Apparently radical surgery was also advised by the surgeon consulted, because three months later the patient and her parents returned again with no procedure having been performed. They now desired to consult with another surgeon, as was recommended several months previously. On consultation the parents finally consented to more radical surgery. At this time the patient presented the following clinical picture:

The patient was a four year old girl who had undergone four previous procedures for the removal of recurrent tumors of the mandible. At the present time (February 3, 1956) examination revealed multiple nodularities along the right and left body of the mandible. The ascending rami of both the right and left side were free from disease. In the submaxillary area of both the right and left sides of the neck, nodules were evident by inspection and palpation, indicating possible metastasis. These nodes were so numerous and extensive that radical excision with bilateral neck dissection was the course of action. The parents consented to this but would not consent to mandibulectomy if this became necessary during the course of operation. The dissection of both submaxillary triangles and the submental area was performed revealing a tumor which had spread from the mandible by direct extension and to the lymph nodes. The mandible was practically surrounded by a tumor which had broken through the cortical plate and engulfed the bone. The tumor tissue was removed as completely as possible without sacrificing the mandible, and again the child made an uneventful recovery.

At this final operation the pathologic diagnosis was definitely established as a fibromyxochondrosarcoma.

Three months later a recurrence was again apparent. The parents would not permit the child to return for further surgery. A faith healer was consulted. The patient's course went progressively downhill with death occurring in about twelve months from metastasis with a cerebrovascular accident.

COMMENTS

In the case reported the problems encountered in diagnosis, surgery and management have been outlined. It was believed that the pathologic diagnosis of myxoma from the initial sections of the lesion most clearly fitted the tissue obtained.

The myxomas that occur in long bones tend to recur and become malignant, while those that occur in the jawbones do not. This particular tumor behaved like myxomas of the long bones. Thoma maintains that myxomas of the jawbones are formed from the mesenchymal portion of the tooth germ rather than from cells of an osteogenic nature. According to Thoma, this theory may be based on the possibility that the cellular elements of a myxoma resemble the spindle-shaped and stellate cells of the dentinal papilla and dental follicle of the tooth germ. These cells, being of a primitive type, produce no collagen or elastic fibers even though in a myxoma certain cells may differentiate and produce collagen fibers so as to classify the tumor as fibromyxoma.

On the other hand, one may have the opinion that a myxoma is a modified form of a fibroma derived from the mesenchymal cells of the

tooth germ which has undergone a myxomatous degeneration.

Odontogenic myxomas usually appear as benign tumors in the maxilla or mandible. They are generally seen in young persons and grow extensively without symptoms except deformity. They are usually associated with unerupted or congenitally missing teeth which substantiates the view that they may be of odontogenic origin. Most of the cases of myxomas of the jaws that have been reported have some sort of odontogenic involvement.

This particular case was probably of odontogenic involvement. It shows the importance of the clinician's viewpoint, for the pathologists consulted interpreted the case as a benign one and the treatment was accordingly. However, this tumor behaved like a malignancy with constant recurrence, finally degenerating into a sarcoma.

Infantile Hemangioendothelioma of the Parotid Gland

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PAROTID tumors are not common in children. Foote and Frazell [1] in their atlas of tumors of the major salivary glands, make the following comments about connective tissue tumors: "The neglect of connective tissue tumors is not due to an oversight, but to lack of sufficient material. Only a mere handful of cases could be assembled from our files and from those of the Armed Forces Institute of Pathology. We have seen occasional examples of salivary gland localization of . . . hemangiomas . . . They are usually of the hypertrophic variety and are found in infants or children. These are apt to be falsely diagnosed as angiosarcomas . . . " The report includes 877 cases, of which 766 were located within the parotid gland.

At the Columbia University Surgical Pathology Laboratory, Stout [3] has records of six cases of hemangioendothelioma of the parotid gland and one of the submaxillary gland in children. This includes records of cases sent to him from the entire country. Of over 1,000 salivary tumors, about thirty-five of which were in children, eleven were carcinomas, eighteen were mixed tumors and seven were hemangioendotheliomas. Andersen [4] reported on 940 tumors in children, of which 768 were benign. There were sixty-five hemangiomas, thirty-seven of which were hemangioendotheliomas; twenty-six were in the skin and subcutaneous tissue. Of the remaining, only one was located in the parotid gland.

McFarland [5] in 1930, recording a congenital angioma of the parotid gland, gave a complete survey of the literature reviewing fifty-seven cases; of these, twenty-one tumors invaded the salivary glands secondarily, thirty-three were in the parotid gland and three were in the submaxillary salivary glands.

In 1943 Stout [6] reported eighteen proved cases of hemangioendothelioma seen since 1920; two cases were in children and none involved the parotid gland. The cases were malignant; however, in "infants apparently [the lesion] is better differentiated and probably less malignant."

Glaser, Mehn and Schultz [7] in 1946 reported a congenital hemangioendothelioma which ran "a highly malignant course" but simply required adequate local removal. Howard et al. in 1950 [8] published a report of twenty-one parotid tumors in children under sixteen years of age seen since 1928 at the Hospital of the University of Pennsylvania and the Childrens Hospital in Philadelphia. Of these there were seventeen true neoplasms and fifteen were primary in the parotid gland. Of hemangioendothelioma, they say it occurs in the first year of life, occasionally at birth, and is benign.

In 1957 Byars, Ackerman and Peacock [9] recorded twenty-four years of tumors of salivary gland origin in children seen at the Barnes Hospital over thirty years, through 1953. There were 470 neoplasms of salivary gland origin, of which twenty-three or 5 per cent were noticed before the patient was eighteen years of age. In this group two capillary hemangiomas were noted in the first six months of life and there was one cavernous hemangioma in an eleven year old child.

In the last year at the Jewish Memorial Hospital, New York, New York, two hemangioendotheliomas of the submaxillary salivary gland and one of the parotid gland were submitted to the Surgical Pathology Laboratory. The latter case is presented in the following report.

CASE REPORT

C. H., a white male child, was born on January 16, 1958, with no apparent abnormalities. When he was ten days old his mother noted a small lump about 1 cm. in diameter in the region of the right parotid gland. The remainder of the examination was normal.

The size of the swelling increased rapidly, and when the child was five weeks of age it was about 4 by 5 cm. in size and located in the right upper part of the neck in the region of the angle of the mandible. It felt cystic but did not transilluminate and no fluid was obtained on attempted aspiration. By nine weeks the swelling was 6 by 7 cm. in size and surgical exploration was undertaken. (Fig. 1.) The preoperative diagnosis was parotid tumor, probably hemangioendothelioma. A preauricular incision was made, continuing and curving behind the lower part of the lobe of the right ear and into the neck. A skin flap was elevated exposing the mass which was found to be a tumor of the lower portion of the parotid gland. The lower end of the mass was dissected free in the upper part of the neck anterior to the insertion of the sternocleidomastoid muscle. The facial nerve was then located at its exit from the stylomastoid foramen. The parotid gland with its contained tumor was then dissected free and removed, preserving the facial nerve and all its branches. The wound was closed in layers and a Penrose drain brought out at the lower angle of the wound. The drain was removed on the first postoperative day and the patient was discharged on the sixth postoperative day. Healing was entirely uneventful, and except for a transient weakness of the mandibular branch of the facial nerve there was no residual evidence of facial paralysis. (Figs. 2 and 3.) The report from the Surgical Pathology Laboratory was as follows:

Grossly, the specimen consisted of a lobulated, encapsulated soft mass measuring 8 by 5 by 3 cm. The upper pole was elongated and the lower pole showed dehiscence of the capsule. In most areas the typical salivary gland structure was maintained, with lobular architecture distinctly present. The lobules ranged from 1 to 3 mm. in diameter. On section more homogeneous areas alternated with lobulated areas. The entire specimen was grayish red and contained numerous thin septums.

Microscopically, sections from all regions of the mass showed preserved duct and acinar structures of a salivary gland. These structures were widely separated by proliferating tissue consisting of bizarre convolutions of vascular channels, some of which were rather narrow; others were dilated and contained blood. These vascular channels were lined by markedly hypertrophic prominent

FIG. 1. Preoperative view of patient C. H.

FIG. 2. Cut surface of specimen.

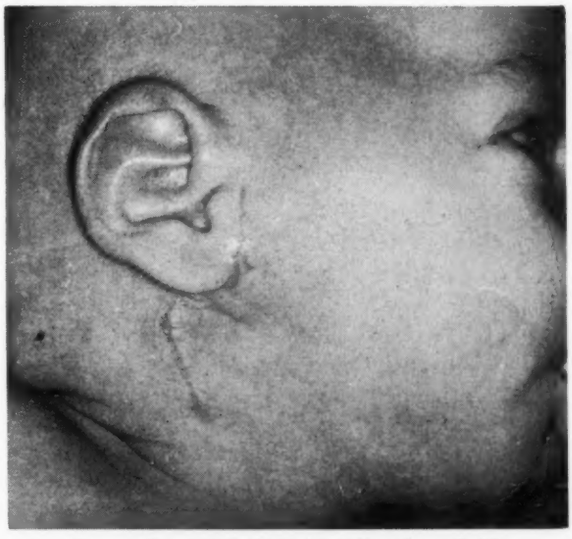

FIG. 3. Postoperative view of patient C. H.

endothelium and there was massive proliferation of such endothelial cells within the intervening tissue. Mitoses were present but widely scattered. Section through the upper pole of the mass showed more glandular tissue but still the presence of proliferating endothelial tumor. The lower pole of the mass consisted almost entirely of tumor with only scant elements of salivary gland.

The diagnosis was hemangioendothelioma (congenital) of the parotid gland. Subsequent reticulum stains confirmed this diagnosis.

SUMMARY

1. Parotid tumors are rare in children.
2. Congenital hemangioendothelioma is a benign lesion. Most appear within the first few months of life.
3. Treatment is complete surgical resection with preservation of the facial nerve.
4. The diagnosis of hemangioendothelioma should be confirmed by reticulum stains.

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Trypsin in the Treatment of Swellings of the Head and Neck

A PRELIMINARY REPORT

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TRYPSIN* is a proteolytic enzyme having the property to reduce edema of the soft tissues and to reverse inflammation. Its exact mechanism of action is not yet fully understood but a plausible explanation is that this enzyme, on administration, is attracted to the inflammatory site where it brings about proteolysis of the soft fibrin barrier, thereby restoring circulation to the area [1].

Intramuscular trypsin has been recommended in the treatment of thrombophlebitis and allied peripheral vascular disorders [2–5]. Recently Kryle, Arnoldi and Kupperman [6], employing the double-blind technic of evaluation, reported that trypsin has a definite place in the physician's armamentarium for the treatment of thrombophlebitis. Hopen and Campagna [7] reported that trypsin was of value in the treatment of traumatic, inflammatory and hemorrhagic ocular disturbances. Golden [8] employed trypsin successfully in the treatment of carbuncles, furuncles and traumatic injuries ranging from contusions and severe bruises to soft tissue involvements in fractures and brain concussions. Silbert [9] employed this enzyme in the treatment of bronchial asthma, chronic bronchitis and bronchiectasis.

The purpose of our investigation was to evaluate the following agents in the treatment of dental infections or swellings about the head and neck of traumatic origin: intramuscular trypsin, intramuscular trypsin plus an antibiotic, and an antibiotic alone.

The rationale for combining an antibiotic with the enzyme was that by removing the inflammatory barrier and thus restoring circulation, the proteolytic action of trypsin would allow a greater concentration of the antibiotic to reach the focus of infection.

MATERIAL AND METHODS

Of the twenty-three cases reported on herein, seven were of traumatic origin and sixteen resulted from dental infections.

Color photographs provided a record of the regression of swellings, erythema or ecchymosis. Photographs were taken of the head and neck of each patient on admission to the hospital or to the outpatient clinic. Treatment was instituted and the patient's progress followed with daily photographs for five successive days. Particular attention was given to keeping the pictures standardized as to pose, distance from camera to patient, lighting and exposure time. All photographs were developed as 35 mm. colored slides for projection.

Treatment of the twenty-three patients in this study differed according to this breakdown: (1) Three patients received only penicillin. (2) Six patients received only trypsin in sesame oil or in gel. (3) Fourteen patients received trypsin in combination with an antibiotic, penicillin in eleven cases and erythromycin in three because of reported allergies to penicillin.

All hospitalized patients received trypsin deep intragluteally, 1 cc. immediately, then 0.5 cc. every six hours for five days. This

* Parenzyme,® National Drug Company, Philadelphia, Pennsylvania.

December 26 December 26 December 31 December 31

FIG. 1. Case XIV, patient J. McK. Fracture of right zygoma. Treatment: 600,000 units of penicillin daily; trypsin, 1 cc. immediately, then 0.5 cc. every six hours.

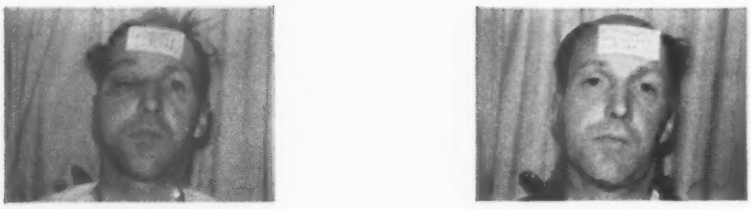

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FIG. 2. Case XXII, patient J. M. Dental abscess; tooth extraction. Treatment: trypsin, 1 cc. immediately, then 0.5 cc. every six hours.

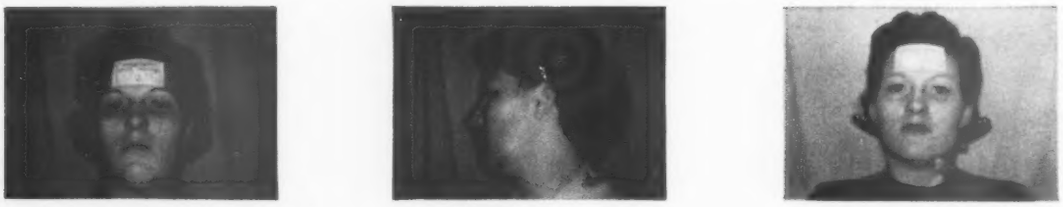

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FIG. 3. Case XVII, patient E. Y. Osteomyelitis of left side of mandible; incision and drainage. Treatment: erythromycin, 250 mg. every six hours; 1 cc. trypsin daily.

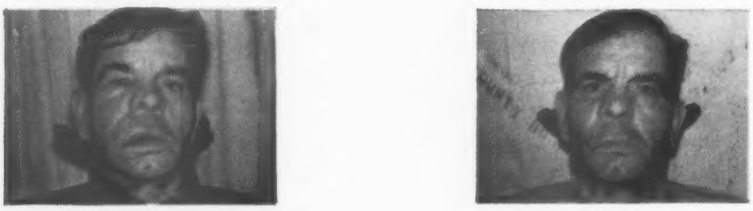

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FIG. 4. Case VII, patient C. S. Dental abscess; incision and drainage. Treatment: 600,000 units of penicillin daily; 1 cc. trypsin daily.

October 24 October 26 October 28 October 31

FIG. 5. Case XVIII, patient J. C. Contusions resulting from an accident. Treatment: trypsin, 1 cc. immediately, then 0.5 cc. every six hours.

December 12

December 12

December 16

December 22

December 22

FIG. 6. Case XI, patient J. M. Abscess of submental space; incision and drainage. Treatment: 600,000 units of penicillin daily; 1 cc. trypsin daily.

October 25

October 25

October 26

October 27

October 28

October 31

FIG. 7. Case V, patient K. R. Dental abscess; incision and drainage. Treatment: 600,000 units of penicillin, three doses; 1 cc. trypsin daily.

TABLE I

TREATMENT OF HEAD AND NECK SWELLINGS: RESULTS IN TWENTY-THREE CASES

Case	Initials	Status and Cause	Medication	Progress
I	O. G.	Hospitalized, trauma	600,000 units penicillin every morning	Fair
II	B. H.	Hospitalized, infection	600,000 units penicillin every morning	Fair
III	F. M.	Hospitalized, infection	600,000 units penicillin every morning	Fair
IV	J. R.	Outpatient, infection	600,000 units penicillin every morning; 1 cc. trypsin in sesame oil every morning	Fair
V	K. R.	Outpatient, infection	600,000 units penicillin every morning; 1 cc. trypsin in sesame oil every morning	Good
VI	F. C.	Outpatient, infection	600,000 units penicillin every morning; 1 cc. trypsin in sesame oil every morning	Good
VII	C. S.	Outpatient, infection	600,000 units penicillin every morning; 1 cc. trypsin in sesame oil every morning	Good
VIII	M. L.	Outpatient, infection	600,000 units penicillin every morning; 1 cc. trypsin in sesame oil every morning	Good
IX	J. M.	Outpatient, infection	600,000 units penicillin every morning; 1 cc. trypsin in sesame oil every morning	Good
X	R. K.	Outpatient, infection	600,000 units penicillin every morning; 1 cc. trypsin in sesame oil every morning	Good
XI	J. M.	Outpatient, infection	600,000 units penicillin every morning; 1 cc. trypsin in sesame oil every morning	Poor
XII	Z. C.	Outpatient, infection	600,000 units penicillin every morning; 1 cc. trypsin in sesame oil every morning	Poor
XIII	E. H.	Hospitalized, infection	600,000 units penicillin every morning; trypsin in sesame oil, 1 cc. immediately, then 0.5 cc. every 6 hr.	Good
XIV	J. McK.	Hospitalized, trauma	600,000 units penicillin every morning; trypsin in sesame oil, 1 cc. immediately, then 0.5 cc. every 6 hr.	Good
XV	E. S.	Outpatient, infection	Erythromycin 250 mg. every 6 hr.; 1 cc. trypsin in sesame oil every morning	Poor
XVI	L. C.	Outpatient, infection	Erythromycin 250 mg. every 6 hr.; 1 cc trypsin in sesame oil every morning	Good
XVII	E. Y.	Outpatient, infection	Erythromycin 250 mg. every 6 hr.; 1 cc. trypsin in sesame oil every morning	Good
XVIII	J. C.	Hospitalized, trauma	Trypsin in sesame oil, 1 cc. immediately, then 0.5 cc. every 6 hr.	Good
XIX	M. Y.	Outpatient, trauma	1 cc. trypsin in sesame oil every morning	Good
XX	M. W.	Hospitalized, trauma	Trypsin in gel, 1 cc. immediately, then 0.5 cc. every 6 hr.	Good
XXI	W. S.	Hospitalized, trauma	Trypsin in gel, 1 cc. immediately, then 0.5 cc. every 6 hr.	Good
XXII	J. M.	Hospitalized, infection	Trypsin in gel, 1 cc. immediately, then 0.5 cc. every 6 hr.	Good
XXIII	V. L.	Hospitalized, trauma	Trypsin in gel, 1 cc. immediately, then 0.5 cc. every 6 hr.	Good

procedure was not practical for outpatients, who therefore received only 1 cc. of trypsin each morning for five days. (Table I.)

In order to obtain an impartial evaluation of the progress of those patients who received the different types of treatment, five persons with varied medical experience who had no definite knowledge of the project were asked to appraise the clinical course of each patient. Each of the twenty-three series of Kodachrome slides showing each patient's progress from day to day was projected for each of the appraisers. When all the slides had been reviewed several times, they were again shown to the appraisers, who were asked to grade each patient's recovery as good, fair or poor. The results were compiled as presented in Table I.

RESULTS

A concise tabulation of the results of treatment is presented in Table II.

Fourteen patients were given trypsin in combination with an antibiotic. Thirteen of these patients received this treatment because of unequivocal evidence of infection, whereas

in the remaining case the antibiotic was given as a prophylactic measure. The results of this treatment were classified as good in ten cases, fair in one case, and poor in three cases. Figures 1, 3, 4 and 7 are illustrative examples of patients whose progress was classified as good. Figure 6 shows a patient in the same category but whose recovery was very slow and who was therefore classed as having a poor result.

Trypsin alone was administered to six patients (Table 1, Cases XVIII through XXIII). The swellings subsided rapidly in all these patients, and their progress was classified as good. (Figs. 2 and 5.)

Three patients received only an antibiotic. These patients recovered rather slowly and were all classified as fair. (Table 1, Cases I, II and III.)

The results of our study seem to indicate that trypsin alone was of definite value in reducing swellings due to traumatic injury. They also show that trypsin combined with an antibiotic was of benefit in reducing edema and inflammation due to infection. These results lend support to the rationale for combined therapy since they suggest that the proteolytic action of trypsin allows a greater concentration of the antibiotic to reach the focus of infection.

Several investigators have reported occasional reactions to the intramuscular administration of trypsin. For the most part such reactions consisted of pain at the site of injection, rashes and induration. In our series twenty patients were given multiple injections of trypsin in the upper outer quadrant of the buttocks for a period of five days; thirteen patients were given an injection each day with 1 cc. of trypsin in sesame oil. Six of this group reported some pain at the injection sites with varying degrees of redness and tenderness. Four hospitalized patients who had received trypsin in gel, 1 cc. on admission followed by 0.5 cc. every six hours, reported the usual discomfort that follows multiple injections but no particular pain at the site of injection. None requested cessation of treatment. It was not necessary to discontinue trypsin therapy in any of our cases because of the reaction to the injection. Now that we are using trypsin in its newest form in an aqueous solution, we have had no complaints from patients receiving multiple injections.

TABLE II

Therapy	No. of Patients	Results		
		Good	Fair	Poor
Trypsin + antibiotic	14	10	1	3
Trypsin	6	6	..	..
Antibiotic	3	..	3	..

CONCLUSIONS

The number of cases in our series is too small to be statistically significant. Therefore a conclusive statement regarding the effectiveness of trypsin in the treatment of swellings about the head and neck cannot be made at this time. Our impression is that intramuscular trypsin is of benefit whether the swelling and inflammation is due to infection or to trauma. The impression is also gained that the swellings abated more rapidly when trypsin was used then when it was not, thus enhancing surgical repair. Intramuscular trypsin combined with antibiotics was efficacious in those cases in which infection and inflammation were present.

Photography is useful as a permanent record in following the clinical course of swellings and inflammation due to traumatic injury and infection.

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Correction of Advanced Rhinophyma by Means of Plastic Reconstructive Surgery

A NEW TECHNIQUE

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THE term rhinophyma is derived from the Greek *rhis* meaning nose, and *phyma* meaning growth. As the derivation implies, it is a disease of the nose characterized by slowly progressive but relatively asymptomatic enlargement of the nose. It is known by such names as copper nose, strawberry nose, whiskey and rum nose, pfundnase, bluhende nase, la drapeau de la biere, fibroma molluscum, acne hypertrophica and cystadenofibroma.

Historically, the disease was first designated as rhinophyma by Hebra [*9,10*] in 1845, and first described microscopically by Simon [*17*] in 1851. In 1864 Virchow [*19*] described the disease as an advanced stage of acne rosacea. Rhinophyma has been represented in classical medical art and caricature throughout the ages. Some striking copies of pictures featuring rhinophyma are found in Dr. Eugen Hollaender's two volumes devoted to "Medicine

1 2

FIG. 1. Typical rhinophyma on an old man. Painting by Hans Holbein (1497–1553).

FIG. 2. Rhinophyma illustrated by Florentine artist Domenico Girlandajo (1449–1494).

in Classical Art" and "Caricature and Satire in Medicine."

Figure 1 is a copy of a painting by Hans Holbein (1497–1553). It hangs in the Prado at Madrid and portrays a typical rhinophyma on an old man. Hollaender states that the coloring of the nose seems to have been toned down by the artist in order to minimize the existence of disease as much as possible.

Undoubtedly, superstition, fear and ridicule have followed the person with rhinophyma throughout the ages, and even in our present day society the greatest trauma of the disease is caused by psychological factors which often drive the afflicted individual into seclusion and social maladjustment.

Figure 2 represents another copy from Hollaender of a painting by the famous Florentine artist, Domenico Girlandajo (1449–1494). According to Hollaender's comments on this painting, speculation as to the etiology of rhinophyma may be portrayed here. He queries whether the small tumor on the old gentleman's right brow may not be intended as a metastasis, thus hinting that at that time rhinophyma might have been considered malignant. He further speculates whether the beautiful child's head was intended to soften by contrast the jarring asymmetry of the bulbous nose of the old gentleman, or whether the granddaughter with perfect features was an attempt to disprove the familial nature of the disease.

Rhinophyma occurs chiefly in men past the fifth decade of life. It is rarely encountered in females, the ratio of males to females usually quoted being 12 to 1. In reviewing the literature for the past thirty years, Bechet [2], Ginsburg [5], Eller [4] and Sams [15] reported seventy-eight cases, four of which were in females. Thus, our investigation reveals a ratio of 18.5 to 1.

ETIOLOGY

The etiology of this disease is unknown at the present time. Such factors as heredity, hot and spicy foods, hot coffee and tea, alcoholic beverages, gastric disturbances, constipation and continued exposure to the elements have been accused in the past. However, as case reports have appeared from various parts of the world, it has become evident that none of these factors is a consistent finding in the disease. Alcoholism, which the layman usually associates with rhinophyma, actually is not a consistent finding in the disease, as shown by Wolfe [21] and others. Numerous cases of rhinophyma in total abstainers are reported in the literature. In our series of fourteen patients, six denied the use of alcohol.

It is generally believed that the disease is the final stage of acne rosacea. Yet, as Stokes and Beerman [18] point out, acne rosacea is three times as frequent in females while rhinophyma is almost solely restricted to males. This is certainly an interesting observation.

There is increasing support for the view that perhaps the endocrine glands play an etiological role in both acne rosacea and rhinophyma. In 1941 Hamilton [7] believed that the male hormone was a prime factor in the etiology of acne. He demonstrated that androgenic substances could stimulate the sebaceous glands. This now seems to be an established fact, and the development of acne in women receiving androgen therapy is recognized as one of the minor but more distressing complications of that type of treatment.

In 1943, Wolfe [21], in his paper on new etiologic and therapeutic considerations of rhinophyma, was in accord with the endocrine theory and in addition suggested a possible relationship to vitamin C deficiency.

In 1947, Ayres and Jensen [1] reported a rather unusual case of otorhinophyma, alopecia totalis, and pruritus which responded to androgen therapy thus suggesting some endocrine relationship to that syndrome and perhaps rhinophyma itself.

In a final analysis of the present day knowledge of rhinophyma it seems likely that no single factor is responsible for its development. Probably factors such as endocrine balance, individual tissue susceptibility, and even antibody reactions contribute to the etiology. Until these fundamental concepts are more fully understood, we will have to continue to speculate as to the etiology and concentrate our efforts on corrective therapy for those individuals already afflicted with the disease.

The microscopic pathology was well outlined by Wende and Bentz [20] in 1904 and today it is the one aspect of the disease which is firmly established.

In 1930, Novy [14] reported a case of carcinomatous degeneration in a typical rhino-

phyma. He found a typical squamous cell carcinoma and treated it by excision.

OLDER METHODS OF TREATMENT

Treatment of rhinophyma has consisted of almost everything from superstitious ritual to cauterization by means of various caustic agents, electrical currents, and carbon dioxide snow. It was believed that a diet low in fat along with abstinence from alcoholic beverages, coffee, tea and spicy foods would benefit the patient with rhinophyma. Perhaps this regimen benefited the patient, but no instances of cure of rhinophyma by such therapeutic means have been reported.

In 1920, Grattan [*6*] described an operation using skin flaps made by two U-shaped incisions over the tumor. The skin was then dissected from the tumor and the mass of rhinophymatous tissue in turn dissected from the nasal structures. The skin flaps were then adapted to the contour of the newly shaped nose. As brought out by Hanrahan [*8*], the disadvantage of this method is that diseased skin is being used to cover the nose, and the remaining glands will continue to grow and produce more hypertrophic tissue. I am doubtful as to securing a good cosmetic result.

A similar surgical procedure was described by Berson [*3*] in 1948. It differs from Grattan's [*6*] in that an attempt is made to utilize normal skin from the upper part of the nose and to stretch it over the raw area after the pathological tissue is removed. It is my opinion, even in the less advanced cases, that a certain amount of pathological tissue will be employed in this type of procedure, and that in the more advanced cases it would be impossible to find enough uninvolved nasal skin to stretch over the area left by resection of the rhinophymatous tissue from nose and alae.

In 1920, Seelig [*16*] reported satisfactory results by paring off the excess tissue leaving only the deepest portions of the sebaceous glands. The resulting islets of epithelial tissue then acted as germinating centers from which the nose was "re-epithelized." This method is employed at the present time by some operators; however, the time factor has not proved satisfactory. I am of the opinion that this does not represent a normal, healthy type of epithelial covering, and that subsequent exposure to the elements will produce changes in color and texture which are not in keeping with a good cosmetic result. Many of these patients do not complain of such changes because the shape of the nose is such an improvement over the preoperative rhinophymatous structure. However, if the truth were known, they would prefer nasal skin more nearly approaching that of a healthy nose. In keeping with the principles of good plastic surgery, the patient deserves a cosmetic result which will approach, as nearly as possible, its normal counterpart and maintain its integrity when subjected to the forces of environment for an indefinite period of time.

I believe that recurrence is a definite possibility in the form of treatment just described, because a certain amount of diseased tissue is usually left on the nose. Also, if the decortication is too vigorous, scarring with subsequent retraction and deformity, requiring further plastic procedures and added expense to the patient, will result.

In 1921, Hanrahan [*8*] reported on a patient operated upon by Reid on whom a Thiersch graft, taken from the patient's thigh, was used to cover the denuded surface. The disadvantage of this procedure is two-fold: first, there is contraction of the split skin graft and second, the graft is not a match for the adjacent nasal and facial skin. This creates another cosmetic problem when the area is exposed to the elements, especially ultraviolet rays, as the pigment response is quite different in the two tissues.

With the increasing use of electrical currents in surgical procedures in the second and third decades of this century, there appeared in the literature reports of treatment of rhinophyma by use of electrodesiccation, electrocoagulation and electrosurgical decortication.

In 1930, Maliniac [*13*] described the reconstruction of a nose which had been partially destroyed by the injudicious use of galvanocautery. The case was one that had been referred to him after extensive sloughing had occurred following an attempt to cure rhinophyma by electrocauterization. He condemns the use of electrocautery on the basis that it is not possible to accurately determine just how much tissue is being destroyed and advises that such treatment should be rejected as unreliable and dangerous. Maliniac is correct in warning against the use of these agents in rhinophyma because of the danger of producing necrosis of the nasal cartilages and

scarring of the remaining nasal tissue. I am in complete agreement with Maliniac's views on this form of treatment; I believe that when such tissue is being removed, a sharp scalpel and a pair of good dissecting scissors are the instruments of choice.

Roentgen rays and radium have been used in treating this disease, but as MacKee [*12*] pointed out in 1927, they are of no real value.

A combined method of paring off the pathological tissue followed by treating the "re-epithelized" areas with such agents as trichloracetic acid, x-rays, radium, or phenol was used by Eller [*4*] in 1933. He reported satisfactory results, but again it is my opinion that such treatment may end disastrously and entail additional plastic operations for reconstruction as well as added expense and misery to the patient.

COMMENTS ON PRESENT DAY TREATMENT

In more recent years, the literature reveals that treatment of rhinophyma has centered around three general types of procedure: (1) decortication by sharp dissection followed by a full-thickness skin graft of matching skin; (2) decortication by sharp dissection and (3) electrosurgical decortication. Electrosurgical decortication is mentioned again only to further condemn its use for reasons already discussed.

At the present time, decortication by sharp dissection is the method most widely used by surgeons. My views on this procedure have been expressed earlier, and from my experience I believe the surgical treatment of rhinophyma should be confined to the field of plastic surgery.

Decortication by sharp dissection followed by a full-thickness skin graft of matching skin was described by Macomber [*11*] in 1946. His technique involved careful decortication followed by a fitted full-thickness skin graft from the supraclavicular region. He sutured the graft in place and maintained pressure on it by means of the long ends of the sutures tied over the first layer of dressing. This is, in general, the type of treatment I recommend except that I place more emphasis on uniform pressure applied to the grafted area.

A full-thickness skin graft placed on the nose should "take" if the basic principles are combined with applied mechanics. In 1942, I placed this idea into actual practice and the surgical results have proved to be highly satisfactory without the loss of a single full-thickness graft in fourteen patients. All patients were operated upon under Novocain® block anesthesia.

FAILURES OF FULL-THICKNESS SKIN GRAFTS

Failures of free full-thickness grafts to the nasal area may be accounted for by any or all of the following complications: (1) infection, (2) collection of serum beneath the graft, (3) pressure necrosis of the graft, and (4) pressure necrosis of the nasal cartilages.

The first complication, infection, may be

3

4

5

FIGS. 3 and 4. Preoperative photographs of a seventy-two year old man with advanced rhinophyma. Onset of rhinophyma at age fifty-eight. Nasal airways completely obstructed. Patient was very self-conscious of his appearance. Denied use of alcoholic beverages.

FIG. 5. Photograph showing postoperative result.

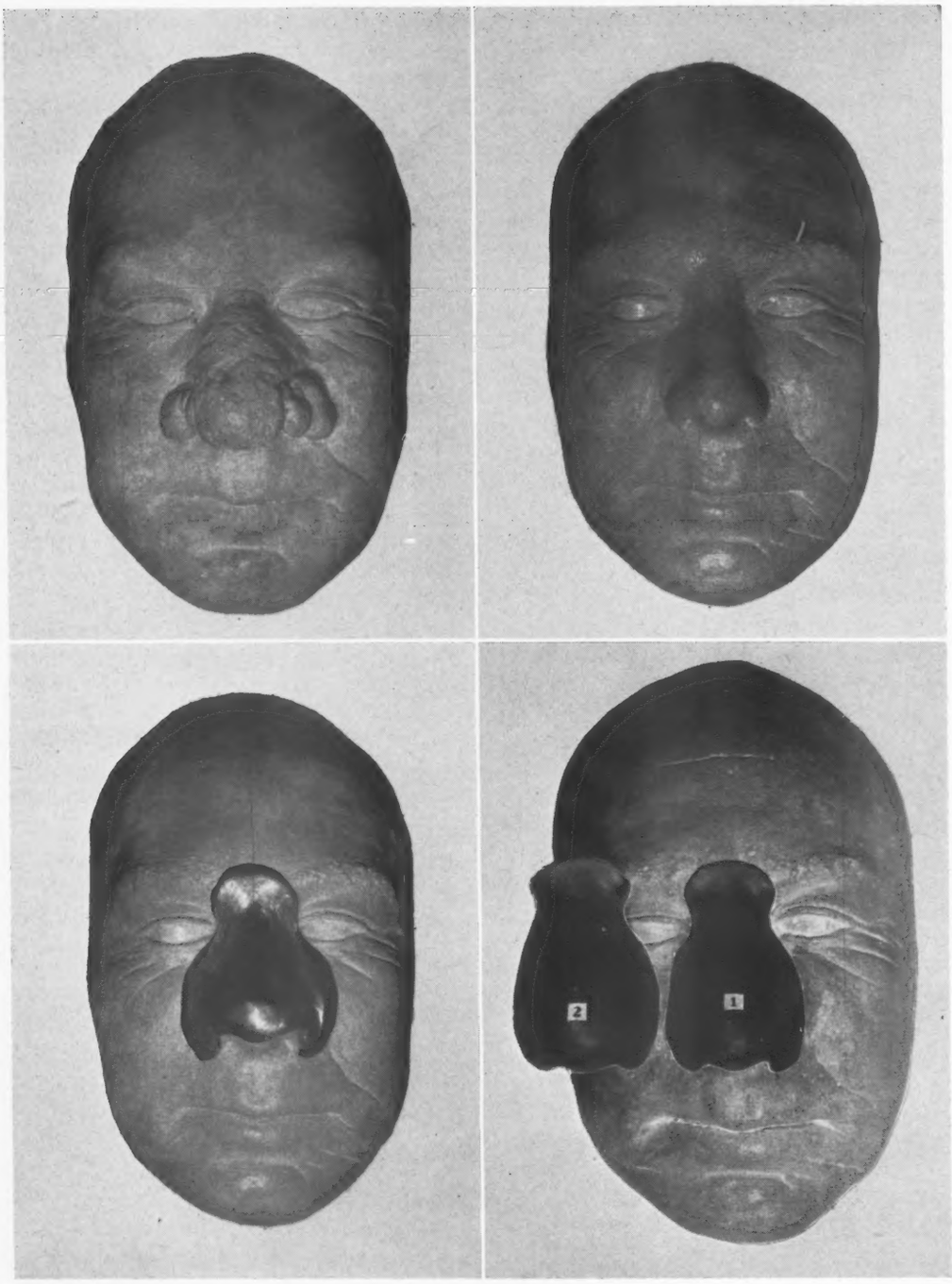
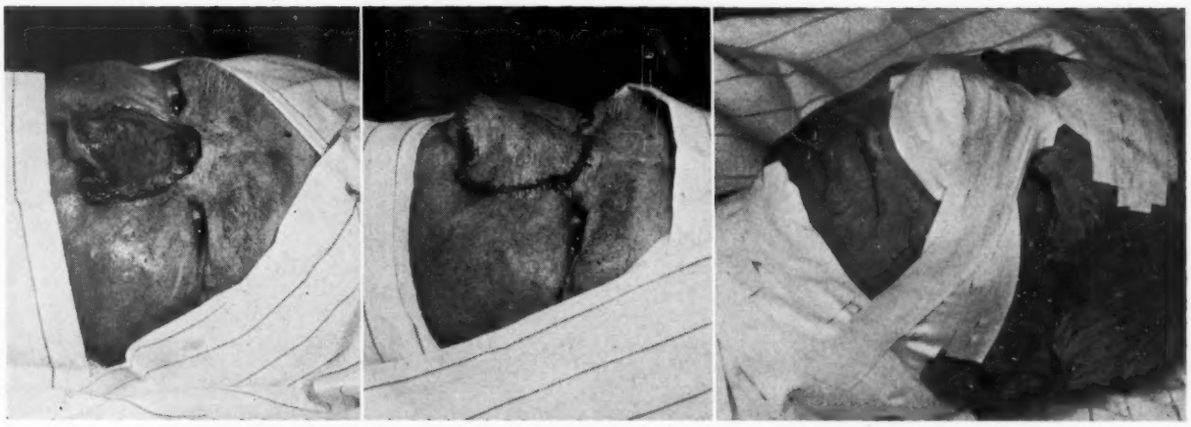


FIG. 6. Artificial stone model cast from face mask of patient. (See Figure 4.)

FIG. 7. Artificial stone model after sculpturing the nose, as shown in Figure 6, to normal anatomical proportions.

FIG. 8. Form-fitting cast silver onlay splint lined with plastic material to exert uniform pressure on the graft.

FIG. 9. Photograph illustrating wax onlay impression models. Impression model No. 1 is form-fitting to sculptured nose. Impression model No. 2 is taken over model No. 1.



10 11 12

FIG. 10. Patient during surgery, showing rhinophymatous tissue removed and exposing the bony and cartilaginous framework, the exact size of which was unknown at time of sculpturing. Impression model No. 1, shown in Figure 9, compensates for size.

FIG. 11. Patient at surgery showing full-thickness skin graft on nose. Donor area is right side of lower part of the neck.

FIG. 12. Photograph illustrating postoperative dressing. The form-fitting cast silver model lined with plastic material exerts uniform pressure upon the graft.

largely overcome by judicious surgical skill, asepsis, and the use of antibiotics. The remaining three complications are dependent upon one important factor, namely, the maintenance of uniform pressure. The pressure must be uniform and great enough to insure hemostasis and prevent accumulation of serum beneath the graft, and yet not so great as to cause necrosis of the graft and the nasal cartilages.

AUTHOR'S TECHNIQUE OF CORRECTION

One of our patients, operated upon by the technique presented herein, is shown before surgery in Figures 3 and 4. Please compare the preoperative condition with the postoperative result as shown in Figure 5.

1. From an accurate face mask, an artificial stone model is cast. (Fig. 6.)

2. The rhinophymatous nose is sculptured on the model to normal size. (Fig. 7.) The plastic modeling compound, lining the silver mold, compensates for variation in the nasal dimensions. (Fig. 8.)

3. To the sculptured nose, a sheet of wax $\frac{1}{8}$ inch in thickness is adapted. This is wax model No. 1. (Fig. 9, No. 1.)

4. Wax model No. 2 is made from a sheet of wax $\frac{1}{16}$ inch in thickness. This is molded over wax pattern No. 1. Wax pattern No. 2 is invested and cast in silver which is $\frac{1}{8}$ inch larger than the sculptured nose. The plastic material compensates for the size of nose being operated upon. (Fig. 9, No. 2.)

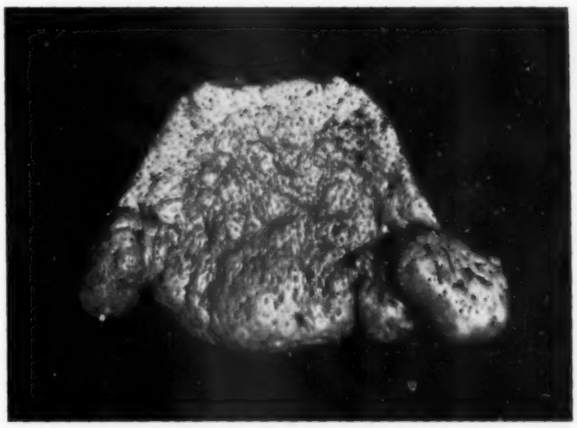


FIG. 13. Pathological specimen removed in one piece. See Figure 14 for photomicrograph.

5. At surgery, the rhinophymatous tissue is completely excised. (Fig. 10.) An accurate transparent pattern is made of the denuded area. A full-thickness skin graft is removed from the cervical neck area in accordance with the pattern.

6. The accurately cut graft is placed over the recipient area and its edges approximated to the surrounding skin edge by means of interrupted No. 3-0 silk sutures. (Fig. 11.)

7. The silver mold is lined with sterile soft modeling compound. (Fig. 8.)

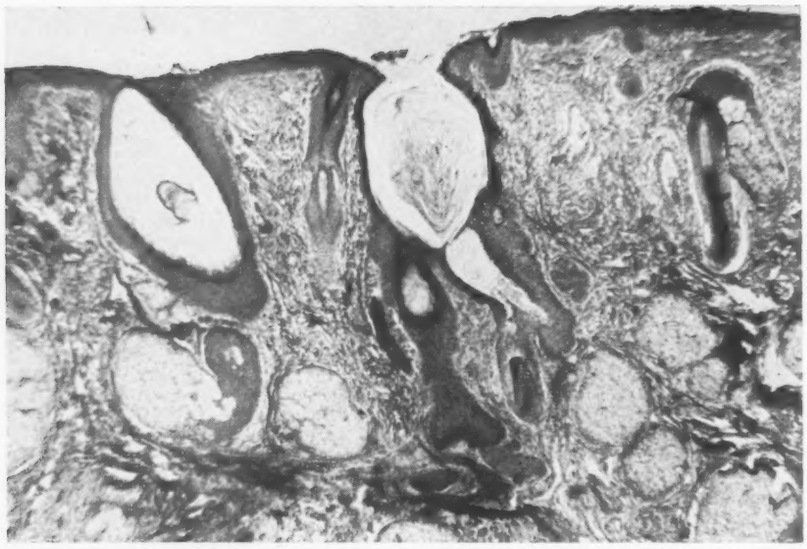


FIG. 14. Photomicrograph of typical non-malignant rhinophymatous tissue. See pathologist's report in text.

8. Counter pressure is accomplished by firmly packing the nares with medicated gauze. The prepared mold is pressed down on the graft and the excess plastic material is cut away. This produces an accurate form-fitting model.

9. The graft is covered with one thickness of bismuth tribromophenate gauze. The form-fitting mold is immobilized with adhesive tape under 30 mm. of mercury pressure. (Fig. 12.)

10. The mold is removed in four days for inspection and the sponging of the graft with sterile saline solution. The mold is reapplied and remains until the twelfth postoperative day. This molded plastic material, held by a form-fitting silver mold, creates uniform pressure over the bony and soft tissue foundation.

The excised rhinophymatous tissue is removed in one piece. (Fig. 13.) Excised rhinophymatous tissue from the five patients included in this report was examined by Dr. James Kahler, Pathologist at St. Vincent's Hospital, Los Angeles, California. Dr. Kahler reported "all specimens examined from the five patients were characterized by an abundance of dilated vessels, connective tissue, chronic inflammatory cell elements, and more or less cystically transformed sebaceous gland hyperplasia. The ducts and glands were dilated and plugged by decomposing and often foul-smelling caseous matter. The inflammatory exudate was usually lymphocytic and plasmocytic, but occasionally granulomatous with an admixture of foreign body giant cells. In some areas the tissue was edematous. There was necrosis of the cellular element resulting from compression of the vessels by the swollen connective tissue." (Fig. 14.)

From this series of fourteen cases employing my new technique for correction of advanced rhinophyma by means of reconstructive plastic surgery, I have selected five cases for presentation in this report. The preoperative condition and the postoperative results in the other four cases are illustrated for comparison in Figures 15 through 22, pages 799 and 800.

SUMMARY

A thorough study of domestic and foreign literature discloses many medical and surgical methods of reconstruction of the rhinophymatous nose ranging from superstitious rituals to partial excision of the nose.

In our series of fourteen cases, the histories revealed that medical treatment did not reduce or eliminate the pathologic rhinophymatous tissue. It is our opinion that the most successful cure of rhinophyma is complete surgical excision and full-thickness skin grafting. This technique involves decortication by sharp dissection, removal of the pathological tissue in one piece (Fig. 13), covering the denuded area with a fitted full-thickness graft of matching skin (Fig. 11) and maintaining constant uniform pressure by a special individualized metal onlay (Fig. 8), designed

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FIG. 15. Preoperative photograph showing a fifty-three year old retired farmer. Note pronounced rhinophyma which began at the age of forty-one. The patient stated that he had been operated upon six years previously but the surgical result was disappointing. Four years previously another doctor treated his nose with "salve" and sulfa drugs taken internally. Two years previously still another doctor treated the patient's nose with x-ray therapy and hot packs. All treatments proved worthless. My examination disclosed a nose double normal size. The skin was cyanotic, rough, full of deep pits, crevices and grooves. Copious foul-smelling infected material exuded upon moderate pressure. The patient was mentally depressed because of his appearance and from derogatory remarks.

FIG. 16. Postoperative photograph showing reconstructed nose by means of a full-thickness skin graft from the lower right side of the neck, employing plastic and mechanical principles. Note blending of graft with adjacent skin of cheek and alae.

FIG. 17. Preoperative photograph of a seventy-five year old man who had had onset of rhinophyma at the age of fifty-five. He was a prolific user of snuff and drank beer from childhood. Nasal airways occluded. Marked inferiority complex.

FIG. 18. Postoperative result. Note normal shape of nose.

and cast from a form-fitting wax pattern. (Fig. 12.) This wax pattern is made over the sculptured nose on an artificial stone model. (Fig. 7.) It is of adequate size to compensate for lining the cast metal onlay with soft plastic material at the time of surgical excision of the rhinophymatous tissue. This mechanical procedure creates a form-fitting splint which

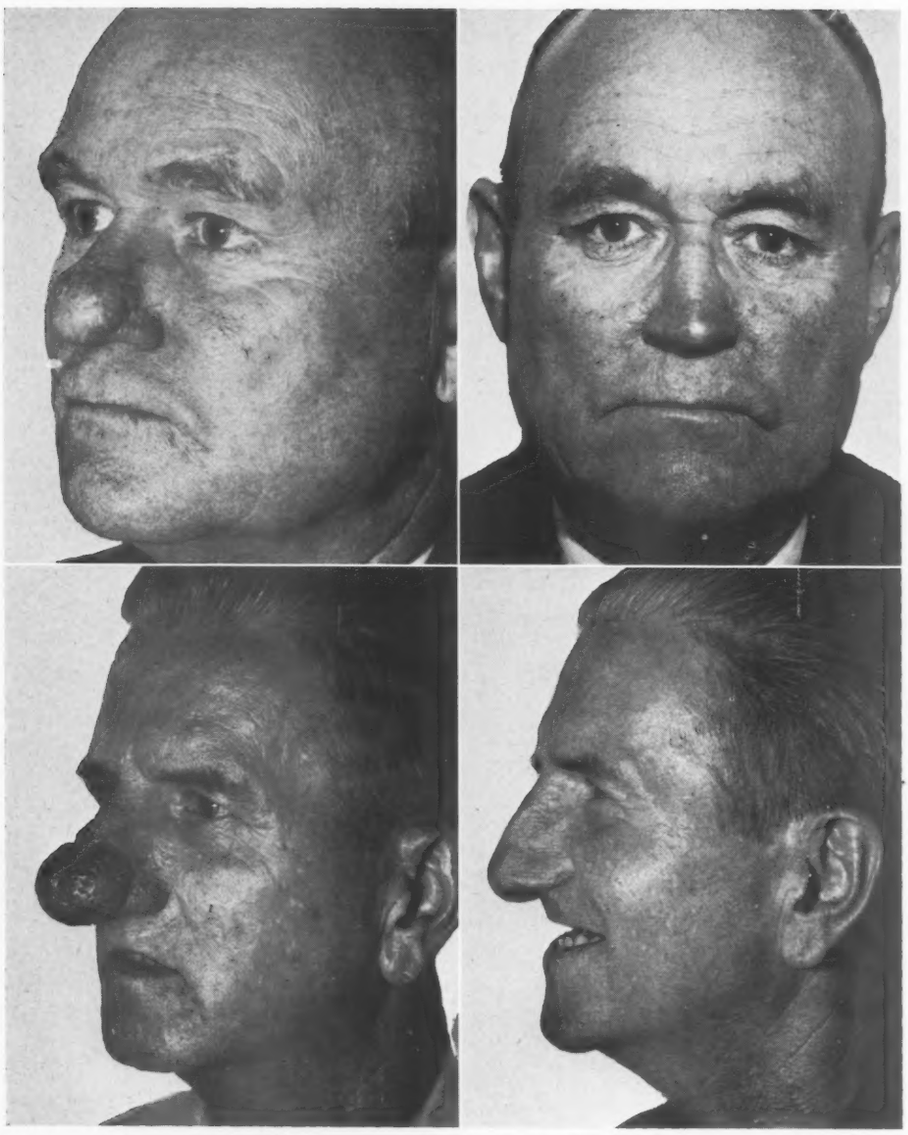

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FIG. 19. Preoperative photograph of a fifty-two year old electrician who had had onset of rhinophyma at age forty-five. The patient was subjected to Kleig lights and sunshine while on location for a motion picture studio. Moderate user of alcoholic beverages.

FIG. 20. Note appearance of nose six weeks following plastic reconstruction. Note blending of graft with face and alae.

FIG. 21. Preoperative photograph of forty-eight year old electrician who had had onset of rhinophyma at age forty-two. The patient was exposed to Kleig lights and sunshine while on location for motion picture studio. He admitted use of alcoholic beverages and was extremely sensitive about his appearance.

FIG. 22. Photograph showing patient six weeks following excision of rhinophyma and placing of full-thickness skin graft taken from neck.

exerts uniform pressure over the bony and soft tissue areas. (Fig. 8.)

For many years, I operated upon patients with rhinophymatous deformities by employing two surgical methods, described in the literature, but without acceptable functional or cosmetic results. Some authors advocate the excision of the rhinophymatous tissue leaving the area denuded, expecting the denuded surface to epithelize to produce a satisfactory skin covering. In my opinion, based on experience, this conception of skin regeneration is a fallacy. Other authors advocate grafting by split skin but, again

it is my opinion, the end result is nearly as bad as leaving a denuded area for expectant skin regeneration. These methods will not produce a physiologic result. The literature discloses only a few authors who advocate the use of a full-thickness skin graft and others declare that a full-thickness skin graft should not be attempted because the graft will not take.

The nose should possess a normal skin covering. It occupies the most prominent position on the face and is subjected to cold weather, burning sun and other forms of trauma. Correction by means of epithelization and fibrous tissue or by split-skin grafting will produce a nose abnormal in color and composed of dense non-resilient tissue which will not resist heat, sunshine or cold weather. Cyanosis, telangiectasis, and peeling of the skin are common complaints of such treated patients. Normally the bony and cartilaginous framework of the nose is covered with skin, subcutaneous tissue and a small amount of muscle tissue. In operating upon a rhinophymatous nose, all pathologic tissue should be excised leaving the bony and cartilaginous framework. (Fig. 10.) A good result cannot be obtained unless the lost full-thickness skin is restored. I am of the opinion that loss of full-thickness skin grafts, as reported by several surgeons, was due to the surgical technique or failure in the application and maintenance of an even 30 mm. mercury pressure dressing.

By all objective tests this new surgical technique has proved successful. A true evaluation of this surgical procedure has been made through a long-term follow-up of these patients. The patients' grateful attitude toward their rehabilitation has been adequately displayed by their readiness to cooperate in this presentation.

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Congenital Posterior Choanal Atresia

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POSTERIOR choanal atresia, a congenital anomaly formerly regarded as rare, is now becoming recognized as one which occurs more frequently than generally appreciated. In the past twenty years, due to a more informed medical profession, an increasing number of cases have been presented in the literature. In addition, many recognized cases go unreported. It is thought by many that there is also a large group that are unrecognized, resulting in asphyxial death in the newborn or very young infant, and classified as asphyxia neonatorum, asphyxia cause unknown, bronchopneumonia or atelectasis. To determine the incidence of this anomaly more accurately, it would behoove the pathologist to examine the nasopharynx in every case of obscure infantile asphyxial death. It would better behoove the obstetrician to establish the patency of the choanae in the process of aspirating mucus from the mouth and nose of the newborn infant by simply attempting to pass the cathether through the nose into the nasopharynx.

Embryologically, the obstruction is due to a persistence of the bucconasal and buccopharyngeal membranes and the intervening mesodermal elements. This partition between the nasal cavity and nasopharynx may be thin or thick depending on the quantity of persisting mesoderm. It may be membranous, bony or a combination of the two, with a central membranous area surrounded by a bony rim. An atresia membranous at birth may become bony at a later date. In a study of 115 cases, Frasier found that 90 per cent were bony. The obstruction may be complete or partial. Approximately 300 cases have been reported in the literature and about 36 per cent of these were bilateral.

As with all congenital anomalies, one must be alert to the possibility of multiple anomalies, and several such cases have been reported, including congenital heart disease. A hereditary tendency is reported.

DIAGNOSIS

It is imperative to establish the diagnosis of choanal atresia as soon as possible, since the infant's life may depend on this. The newborn infant instinctively breathes through the nose. Mouth breathing is a habit acquired weeks or months later, probably during the crying experience. The bilateral case of atresia causes trouble immediately after birth and the symptoms are usually most urgent. If the mouth happens to be open, the child will be comfortable; but when the mouth closes, an immediate emergency ensues during which the child struggles for breath, exhibits suprasternal and infrasternal retraction and becomes cyanotic. The infant tightens the lips together thereby depriving itself of any possible air supply. If at this stage the child begins to cry, the episode ends favorably. However, if he does not cry and if the emergency is not discovered and treated immediately by the establishment of an airway, the infant will die of asphyxia. It is evident that such cases need constant attention until mouth breathing is learned, which some infants accomplish early and others late. Occasionally an infant will be a mouth breather at birth, which probably explains why some cases of bilateral atresia are not discovered for years. Feeding, of course, is another problem. The child must be interrupted frequently at meals. Aspiration of milk and coughing are common, sometimes resulting in bronchopneumonia. Malnutrition and dehydration develop often.

In the older child with bilateral atresia there is a constant viscid, glairy nasal discharge, inability to blow the nose, anosmia, constant mouth breathing and a voice quality characteristic of nasal obstruction.

In the unilateral case there may be no respiratory difficulty or feeding difficulty until the patent airway becomes occluded by nasal infection or mechanically obstructed by placing the baby in the crib in such a fashion as to compress the nostril on the patent side. Nasal obstruction, discharge and anosmia are present only on the affected side. These cases, of course, do not usually present the compelling problems of the bilateral case.

The diagnosis may be made by attempting to pass a flexible catheter or metal probe through the nose into the nasopharynx. It has been recommended that methylene blue dye be dropped into the nose and the pharynx inspected for staining, or radiopaque oil used and traced by x-ray studies. These diagnostic methods, although useful, are not foolproof, as a small inadequate choanal opening may admit the passage of dye or oil into the nasopharynx and be misleading.

TREATMENT OF BILATERAL ATRESIA

Once the diagnosis has been established, treatment depends on the severity of the symptoms, the age of the patient and the type of atresia present. In the bilateral case in the newborn, steps must be taken immediately. Medovy and Beckman [*12*] recommend the use of a feeding nipple with a large opening in it, as an airway, placed in one corner of the patient's mouth and through which the infant can be fed with a medicine dropper without serious respiratory difficulty. Feedings of course must be interrupted frequently. Hough [7] recommends the passage of a plastic tube through the mouth into the stomach and a small catheter between the palate and tongue. Several other types of airways have been used with success, but in any case airways or stomach tubes cannot be tolerated long and the nutrition suffers rapidly. Therefore in these cases surgery must be initiated very shortly. Tracheotomy has been recommended, but this procedure is fraught with danger in the newborn and the postoperative care is demanding.

The general surgical approaches described for correction of bilateral atresia in the infant are (1) transnasal and (2) transpalatine. For the newborn, opinion favors the transnasal approach as the more feasible one. The operation consists essentially of making an opening in each choana via the nares, using knives, curets, chisels, drills, trochars, forceps, caustics or electrocautery for this purpose and maintaining this opening by the use of rubber or plastic tubes for weeks or months. Much care must be exercised to avoid penetrating the base of the skull. Periodic dilatation is usually necessary to avoid stricture. Secondary surgery may be necessary at a later age.

The transpalatine approach is more practical in later months or years and there are many reports of cases treated successfully by this route after the child is six months of age. Some operators prefer to make a midline incision through the mucoperiosteum of the hard palate extending into and through a portion of the soft palate, retracting the soft tissues laterally, thus exposing the defective area to direct vision. Others prefer to make a transverse, anteriorly curved incision, reflecting the mucoperiosteum of the hard palate as a posteriorly hinged flap, exposing the region. It should be noted at this point that if the latter procedure is followed care must be taken to make the incision close to the bases of the teeth, preserving both posterior palatine arteries. Failure to observe these precautions may result in formation of a fistula or necrosis of the palatal flap, as has been reported. Additional working room may be obtained by extending the incision around the maxillary tuberosities and carefully stretching the posterior palatine arteries from their canals. The atretic membrane and bone are then resected along with a section of the posterior vomer and posterior edge of the hard palate, preserving and manipulating enough mucous membrane to cover denuded areas. The palatal flap is then sutured back in its anatomical position. The ends of the sutures should be left long enough to allow tying them over a dressing which will maintain the palatal flap against the palatal bone. This dressing can be removed in a few days, after the flap has adhered. If the molar teeth are present, they can be used as anchorage points for sutures to maintain a dressing. Rubber or plastic tubes of caliber sufficient to fill the newly made choanae are then inserted through the nose into the nasopharynx. Some surgeons have used one long tube, entering one nostril, passing through each choana at the posterior end of the vomer, and emerging

through the other nostril, and each end fastened together in front of the nasal columella in the shape of a doughnut. After healing is complete the tube(s) is removed. Periodic dilatation may be necessary, although not frequently.

The choice of operative approach, whether transnasal or transpalatine, should be influenced by the thickness of the obstructing membrane. This may be difficult to ascertain but at times can be done by palpating the nasal side with a probe and at the same time examining the nasopharyngeal side with the finger. If one can be sure that the partition, whether bony or membranous, is thin, it can be satisfactorily treated by the intranasal approach; but if the thickness cannot be determined or if the partition is known to be thick, the transpalatine approach offers more chance of success since it allows resection of the mesodermic structures under direct view and covering of the resulting raw areas with epithelium to prevent subsequent stricture. Simply breaking through a thick atretic membrane or removing it piecemeal and haphazardly through the nose will only result in collapse of the soft tissues after the tubes are removed, and in eventual stricture.

TREATMENT OF UNILATERAL ATRESIA

This type may go unrecognized for a considerable length of time, with respiratory difficulty being noticed only when the open nasal passage is occluded.

Most operators agree that surgery in the unilateral case may be postponed until the child reaches the age of nine or ten years of age or later. The transnasal route is very effective. One may remove the posterior half of the nasal septum along with its mucoperiosteum, close to the floor of the nose, creating in effect a large posterior perforation of the nasal septum through which the occluded side communicates with the open side, using the one patent choana for both sides. One may carry removal of bone and membrane laterally when the posterior end of the septum has been reached in an attempt to make the posterior opening larger if necessary. A transeptal approach accomplishing the same result has been described. The transpalatine approach may also be used depending on the surgeon's preference.

The following case illustrates a surgical technic which proved to be efficacious in a case of bilateral choanal atresia in an adult.

CASE REPORT

J. G. R., a twenty-two year old American-Portuguese woman, was seen at the Massachusetts Eye and Ear Infirmary complaining of inability to breathe through the nose since birth. History of respiratory distress in infancy was vague, but persistent nasal discharge and slow feedings were noted. Tonsillectomy and adenoidectomy when she was six years of age had not helped. The cause of the nasal obstruction evidently was not discovered prior to the present examination, which revealed glairy, viscid nasal discharge, pale nasal mucosa and complete absence of nasal respiratory exchange. A rubber catheter passed through the nares met with obstruction on each side in the region of the posterior choanae. Posterior mirror rhinoscopy was unsatisfactory. Radiopaque studies revealed complete bilateral choanal atresia; a thin plate of bone could be seen extending from the sphenoid sinuses to the posterior edge of the hard palate. Sinus films were negative. General physical examination showed no other congenital anomalies.

Operation was performed on October 19, 1957, under general anesthesia. A Brown-Davis mouth gag was applied with the patient in the recumbent position and the surgeon at the head of the table. (Fig. 1.) Digital examination revealed the nasopharynx to be funnel-shaped with the apex of the funnel toward the nasal cavity. The bony outline of the posterior choanae could not be palpated, and it was felt that a thick pad of soft tissue existed between the examining finger and the occluding bony plate seen on x-ray film, representing thus a thick choanal atresia. (Fig. 2.) A horseshoe-shaped incision was made through the palatal mucosa and extended around each maxillary tuberosity, outlining a tongue-shaped flap which was elevated from the bone. The posterior palatine arteries were carefully stretched from their canals to supply additional working room. (Fig. 3.) At the posterior edge of the hard palate the direction of the bone abruptly changed toward the sphenoid sinus. The soft tissues were easily elevated exposing a continuous plate of bone completely occluding both choanae. (Fig. 4.) This bone was removed without difficulty with mallet and chisel, bringing into view the bucconasal membrane. The dimensions of the choanae were found to be infantile. Therefore the bony openings were enlarged in all directions, including removal of the posterior edge of the vomer and hard palate. The bucconasal membrane was incised along the periphery of each bony opening but left attached at the floor of the choanae, thus creating two mucosal

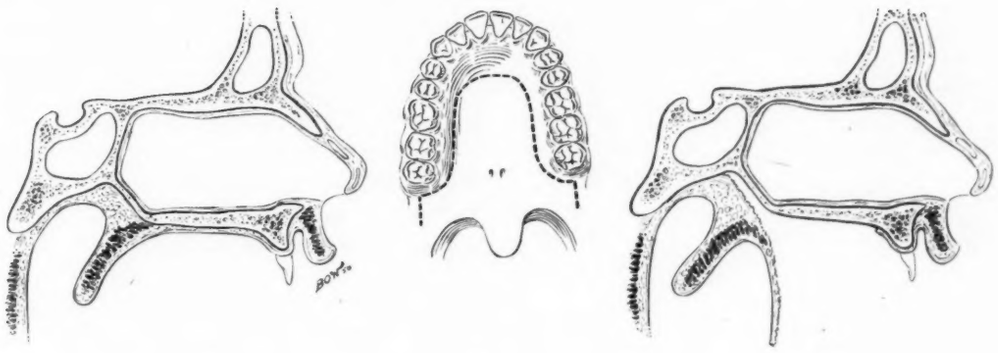

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FIG. 1. Diagram illustrating the condition found at operation. Note the thickness of the obstructing partition, due mainly to the mesodermal soft tissues. This type of case is best approached by the transpalatal route.

FIG. 2. The horseshoe-shaped incision affords excellent exposure. There is no danger of necrosis of the palatal flap if both posterior palatine arteries are preserved, and hence no possibility of formation of a fistula.

FIG. 3. The palatal flap is elevated from the bone and the bony atretic partition is exposed with ease.

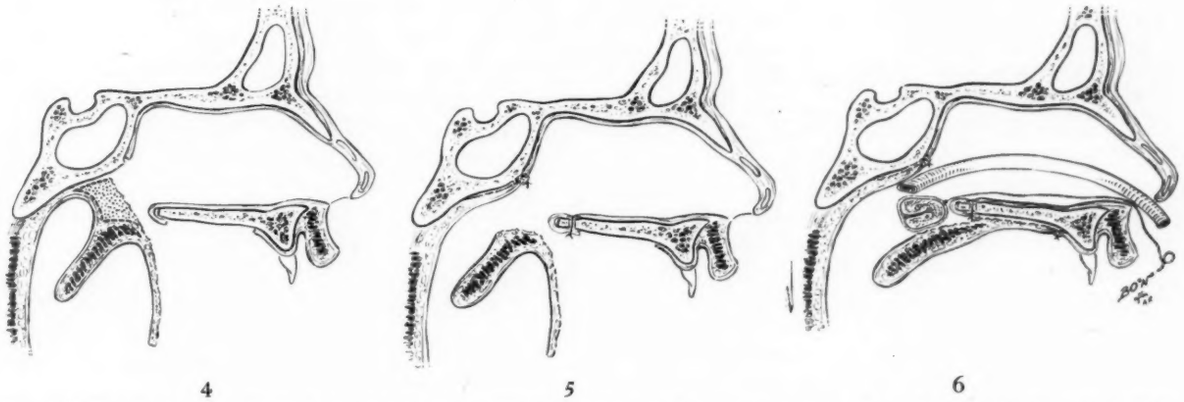

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FIG. 4. The obstructing bone is resected along with the vomer and a transverse section of the posterior edge of the hard palate. The nasobuccal mucosa is then incised at the roof and sides of each choanal opening and the resulting flaps reflected back over the edge of the hard palate. Resection of the stippled area is a "must."

FIG. 5. The bucconasal flap on each side is maintained over the posterior edge of the bony palate by a suture passed through a drill hole. The buccopharyngeal mucosa is incised at its junction with the soft palate and sutured to the mucosal edge at the roof of each choana.

FIG. 6. Although manipulation of mucous membrane flaps minimizes raw areas, it is wise to cover any remaining raw areas with a split-thickness skin graft, utilizing a postnasal pack as a carrier for the graft. Rubber or plastic tubes are best introduced at this time.

flaps, each of which was reflected back over the posterior bony palatal edge and held in this position by a suture passed through a drill hole made near the edge of the bony palate. The soft tissue partition remaining on the nasopharyngeal side of the original bony obstruction was now examined and found to be about ⅜ inch thick. Although technically difficult, it was thinned by carefully resecting the mesodermal tissues from the mucous membrane. (Fig. 5.) It was then possible to incise the buccopharyngeal mucosa transversely at its junction with the nasopharyngeal side of the soft palate. This was facilitated by tenting up the mucosa into the operative wound by a finger in the nasopharynx. This mucosal flap with its pedicle on the posterior nasopharyngeal wall was brought forward and sutured to the mucosal edge at the roof of each

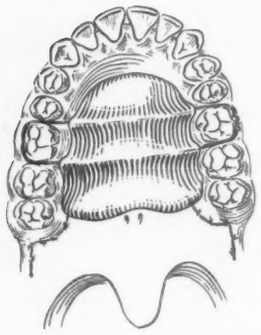

FIG. 7. The palatal flap is maintained against the palatal bone by softened dental compound applied over a bridge of wire extending between the first molar teeth. Vaselined gauze is interposed between the compound and the mucosa.

choana. Although the raw areas were minimized by this procedure, scattered areas needing epithelium still existed, along with a larger area on the superior surface of the soft palate. (Fig. 6.) Epithelial covering was supplied to these regions by a split-thickness skin graft around a postnasal pack. Two No. 6 Davol (polyethylene) tubes were passed through the anterior nares and extended through the posterior choanae, each passing superior to the postnasal pack.

The palatal flap was then sutured in its anatomical position and maintained against the palatal bone by softened dental compound over a bridge of wire extending between both upper first molar teeth. (Fig. 7.) The postnasal pack was removed on the eighth postoperative day, and the nasal tubes on the twelfth day. The patient has been able to breathe comfortably through both sides ever since. Postoperative dilatation of the choanae has not been necessary, as there have been no signs of appreciable stricture.

COMMENTS

Several technical points seem worthy of emphasis:

1. The midline vertical transpalatine incision, although it affords good exposure, may result in a fistula. The transverse curved incision close to the posterior edge of the hard palate has also been reported as frequently resulting in formation of a fistula. The horseshoe-shaped incision, preserving both posterior palatine arteries as described herein, results in a longer palatal flap which is very viable and generously overlaps the palatal bone when replaced. Exposure by this method is good and there are no complications in healing of the flap.

2. The bony choanal openings should be enlarged as much as possible. This necessitates removal of a transverse section of the posterior edge of the hard palate and a portion of the vomer.

3. When the obstructing partition is thick, the mesodermal tissues responsible for the thickness should be resected completely, leaving a thin mucous membrane on the nasal side and a thin mucous membrane on the nasopharyngeal side which should be used judiciously to cover denuded areas. Whenever possible, any remaining denuded areas should be skin grafted to prevent stricture.

SUMMARY

The incidence of congenital posterior choanal atresia is higher than generally appreciated and one should suspect this condition in any infant with obscure respiratory difficulty. The diagnosis is made simply when suspected. Treatment depends on the severity of the symptoms, the age of the patient and the character of the obstructing partition. The two general surgical approaches are described and a case of bilateral choanal atresia in an adult is reported with detailed operative notes.

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Deformities of the Nasal Tip

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THE tip of the nose, the most prominent portion of the face, is an interesting subject for discussion.

The abnormalities of the nose, be they congenital, developmental or traumatic, should be corrected.

The baby who has bilateral cleft lip and palate usually has a short columnella, broad tip of the nose and, occasionally, alar cartilages which are misshapen and misplaced.

The person with unilateral cleft lip frequently portrays a nasal tip deformity in that the alar or lower lateral cartilage on the cleft side is far from its normal position and is flattened.

The cleft nose with two individual nostrils, the over-developed alar cartilages producing barrel-shaped nostrils and the twisted nasal tip—all need surgical correction.

The wide columnella, the short columnella, the hook or beak tip, the snub tip and many others may be corrected by one basic procedure. Naturally, the age and size of the patient play an important role.

The technic to be described was conceived by me about twelve years ago. A V-shaped incision is made in the lower border of the nose. A dorsal flap is reflected by starting the V-shaped incision in the central portion of the columnella. (Fig. 1A.) The incision is carried upward in an arc, out to the lateral aspect and lower border of the nose, keeping the width of the skin between the incision and the border of the vestibule one-half the width of

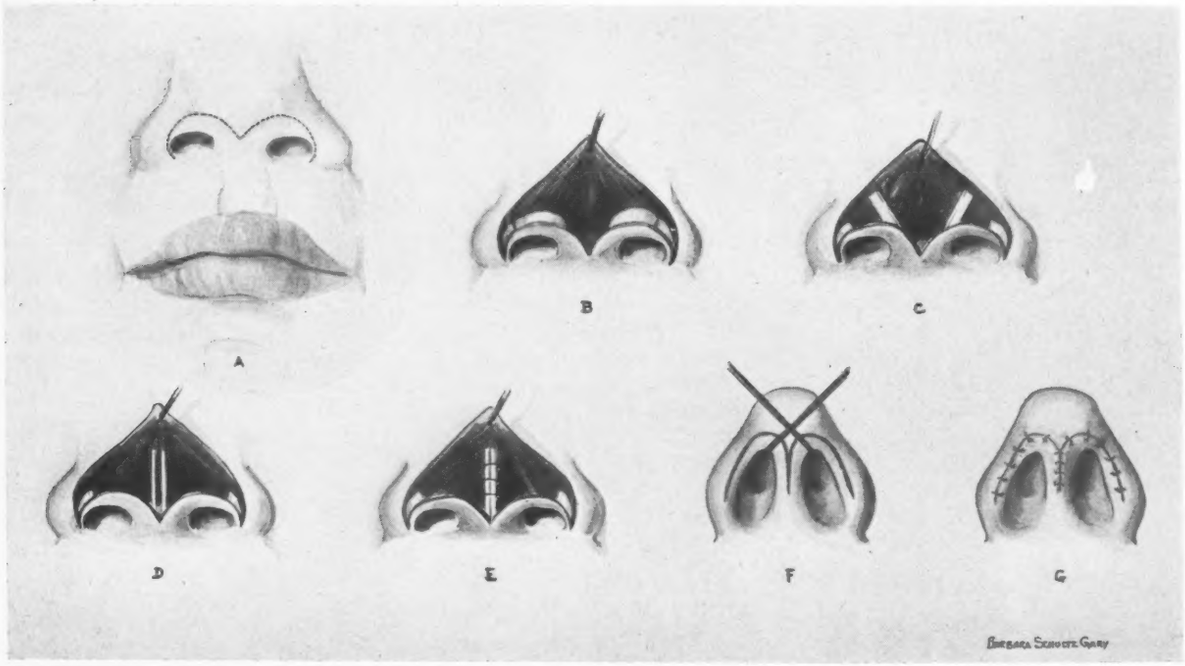

FIG. 1.

the columnella. This should be done far enough on each side to get the desired length of the columnella. The incision is carried through the full thickness of the skin down to the cartilages. The skin is then elevated by blunt and sharp dissection with a small suture scissors. The alar cartilages are exposed completely and the dissection is carried high up to the glabellar region and down to the lateral border of each alar cartilage. (Fig. 1B.) This portion of the dissection is important in that all the redundant tissue between the alar cartilages in the midline is removed and these cartilages are mobilized completely. This then gives the operator a chance to move either or both cartilages in any direction to obtain the desired end result.

In the case of a very broad flat tip, the cartilages can be cut as shown in Figure 1B and C, raised as in Figure 1C and D and then sutured together as in Figure 1E. This forms a good cartilaginous post or framework to make a longer columnella.

By placing a tenaculum in either nostril and crossing the handles over each other, applying firm traction (Fig. 1F), one can get an even balance and desired shape to the nasal tip (Fig. 1G) while it is being sewn. A nasal pack of vaseline gauze and an external (Schultz) nasal splint will support the tip until it has healed. The pack should be kept in place about one week and the external splint for about two weeks. This may vary in direct proportion to the support necessary in any particular case.

This basic procedure, naturally, may and should be tailored to suit each individual instance. The addition in the length of flaps, the excision of redundant tissue, the implantation or shifting of cartilages, all must be effected successfully by the surgeon at the time of the operation or reconstructive procedure.

Cooperation on the part of the patient is an important phase in the success of most operations. This is, obviously, unobtainable in dealing with children. However, I have operated upon many such patients when they were less than a year old with good results. The optimum time for these procedures, however, is when the patient has fully matured.

Coexisting Internal and External Laryngoceles

REPORT OF A CASE

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VENTRICULAR laryngocele, named and described by Virchow [1] in 1863, is a cystic dilatation of the sacculus or appendix of the ventricle of Morgagni. Clinically, this condition was recognized in 1829 by Larrey, a surgeon in Napoleon's army of occupation in Egypt. He observed that many of the men reciting prayers from the temple minarets were afflicted with tumors of the neck. These tumors, he noted, were air cysts in the soft tissues that eventually led to the symptoms of aphonia and venous compression.

Anatomically, it was Galen (300 A.D.) who first noted a slit between the true and the false vocal cords of the larynx. Morgagni (1741) described it in more detail, and this ventricle bears his name. In 1837 Hilton [2] drew attention to the anterior upward projection of Morgagni's ventricle, a vertical blind pouch known as the laryngeal sacculus or appendix.

Embryologically, the ventricle is formed by the splitting of the common thyroarytenoid sphincter into two parts, a lower internal segment and an upper external segment. The upper segment becomes the false cord and the lower becomes the true vocal cord. A recess is left between the two, representing the ventricle. A saccule is present at the end of the second fetal month, remaining relatively large in the newborn, with regression occurring at the age of six years [3].

Histologically, the laryngeal ventricle and the sacculus are covered with ciliated columnar epithelium. The stroma contains lymphoid cells, singly or in groups. The submucosal glands are tubular with mixed mucous and serous cells.

Incidence. Laryngocele is a relatively rare condition, only approximately ninety-six cases being reported in the literature to date. It is of interest to note that of these, forty-five were reported in the last ten years (1947 to 1957). Ten cases were associated with carcinoma of the larynx, eight were complicated by infection and four were of the combined internal-external type. The remaining cases were pure air cysts of the external or internal type. Cases of bilateral external laryngoceles were reported, but there were no cases of bilateral internal laryngoceles.

Etiology. The sacculus from which laryngocele formation stems is considered by some authors to be an atavistic analogue of the air sacs normally encountered in the orangutan and the chimpanzee, illustrating developmental changes of evolutionary degeneration [5,6,15]. Others believe that abnormal increase in the intralaryngeal air pressure, such as in coughing, singing, playing wind instruments and glass blowing distends the sacculus so that it projects beyond the confines of the larynx [4,6,7]. Another view is that the valve-like closure occurs in the sacculus so that air is allowed in but not out. Distention of the sacculus is thus caused, which ultimately leads to the formation of a laryngocele. It is probably a combination of all the aforementioned factors—a long sacculus, increased intralaryngeal pressure, as well as a check valve mechanism—that produces a laryngocele. A true laryngocele should not be confused with a similar mass containing air caused by trauma to the larynx. In this

instance air may be caught between the tissues and held by a ball-valve arrangement, and gradually enlarge to appear as a laryngocele. An air sac is formed in this manner and is not lined by mucous membrane but rather by the tissue in which it forms [*4*]. Another condition which may be confused with a laryngocele is a true prolapse of the ventricle, a condition which results from inflammatory edema or hypertrophy with bulging of the ventricle [*8,18*].

Classification. Various authors have presented classifications of laryngoceles [*6,7,11, 15,21*]. Classifications are based on etiology, relation to the thyrohyoid membrane and relation to the larynx; the cyst contents have also been used as a basis. From the observations on the case reported herein, the following classification is suggested: (1) Internal laryngocele: The presence of a cystic dilatation within the lumen of the larynx with the base arising from the internal wall of the ventricle of Morgagni. (2) External laryngocele: The presence of a cystic dilatation outside the larynx with the base arising from the external wall of the ventricle of Morgagni. (3) Combined internal and external laryngocele: The presence of a cystic dilatation into the lumen of the larynx as well as a cystic dilatation external to the wall of the ventricle of Morgagni.

The content of a true laryngocele is air. The histological preparation shows ciliated columnar epithelium, and mixed mucous and serous tubular glands.

Symptoms. Laryngoceles may be asymptomatic. The internal laryngocele can produce voice changes, varying from hoarseness to complete aphonia. Partial respiratory obstruction with dyspnea to complete obstruction of the airway may occur, necessitating emergency tracheotomy. The external laryngocele produces a swelling in the neck that increases in size on coughing or straining. In the mixed type a combination of the previously mentioned symptoms are present. Local discomfort or venous compression with resultant headaches may occur.

Diagnosis. Palpation reveals a soft elastic mass that may give a hissing sound of escaping air in the throat on pressure [*6*]. The presence of any of the aforementioned symptoms as well as the presence of a tumor or mass in the neck is an indication for roentgenological studies. These will reveal a typical, sharply defined, radiolucent area at the level of the hyoid bone that is ovoid in shape. Mirror laryngoscopy reveals a swelling above the true vocal cords that may enlarge on straining. Direct laryngoscopic examination will present the same findings in more detail. Aspiration of air will cause collapse of the swelling and confirm the diagnosis.

Treatment. Asymptomatic laryngocele requires no treatment. A laryngocele, internal or external, producing symptoms should be removed surgically through an external incision. Internal removal through the laryngoscope and the injection of trichloroacetic acid into the cyst has been attempted but this should be discouraged.

CASE REPORT

A twenty-two year old white man was admitted to the hospital from the outpatient department with a swelling on the left side of the neck of approximately five months' duration. The swelling had appeared suddenly during the course of a normal conversation and disappeared three days later. A month later it reappeared and persisted to the time of admission to the hospital. A week after the swelling reappeared the patient's voice became hoarse, finally resulting in aphonia. No medical treatment was sought during this time.

Family and past histories were non-contributory. The patient liked to sing.

Physical examination revealed a normal-appearing male of moderate build with a moderate swelling of the left cervical region between the angle of the mandible and the thyroid cartilage. (Fig. 1A.) The mass was soft and elastic in consistency and immediately resumed its original shape after release of pressure. On coughing or straining the swelling increased in size. There were no other abnormal physical findings. Laboratory examinations were normal.

Mirror laryngoscopic examination showed that just below a normal epiglottis a large, smooth swelling was present on the left lateral hypopharyngeal wall extending down to and obliterating the left vocal cord. The right cord was normal in appearance and motility.

On direct laryngoscopy, as the epiglottis was elevated anteriorly, a sausage-shaped, avascular, bulging mass was visible on the left side extending into the left aryepiglottic fold. Upon deep expiration another smaller-sized mass was seen below the larger mass; this smaller mass had a bluish discoloration on its surface. No openings were noted in either mass. There was barely enough space between the left side and the right vocal

1A

1B

FIG. 1. A, preoperative view of patient showing location of external swelling. B, x-ray of neck showing cystic cavity.

cord to allow for respiratory exchange. The skin on the left side of the neck over the area of the bulging mass was pierced with a No. 18 needle and air was obtained upon aspiration. The larger mass was collapsed when the laryngoscope was reintroduced. The lower bluish colored mass was still present.

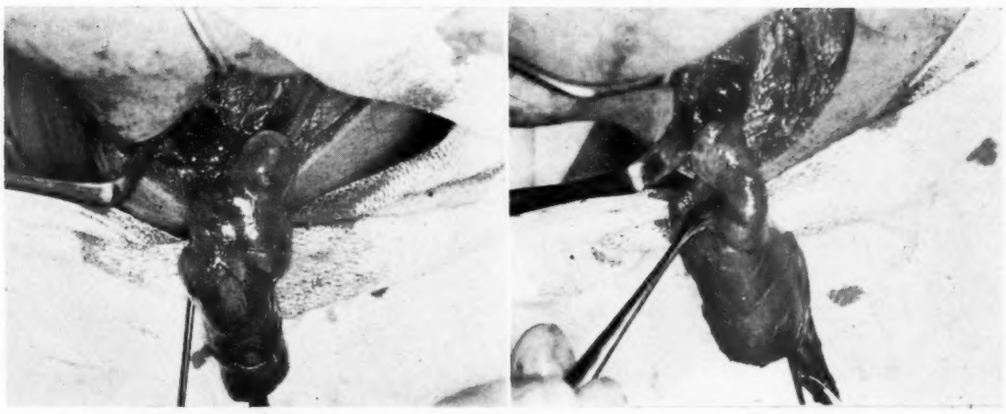
Roentgenological examination showed a large ovoid shadow of increased illumination on the left side of the neck at the level of the hyoid bone. (Fig. 1B.) In view of these findings a diagnosis of coexisting internal and external laryngoceles was made.

On September 11, 1957, with the patient under local anesthesia, tracheotomy was performed through a vertical midline incision. Anesthesia was started with intravenous Pentothal® and an endotracheal tube was placed through the tracheal opening. Anesthesia was maintained with nitrous oxide, oxygen and ether. A left curved oblique incision was made 2 cm. below the angle of the mandible from the anterior border of the sternocleidomastoid muscle to the midline between the hyoid bone and the thyroid cartilage. The incision was carried down through the platysma muscle and the cystic mass was located. By blunt and sharp dissection the cystic mass was freed intact. The superior laryngeal nerve was located and isolated. The cyst was then separated from the hyoid bone and was found to arise from the region of the thyrohyoid membrane to the left of the midline. The thyrohyoid membrane in this area was not present. The cyst was dissected free and found to bulge under the inner surface of the left side of the thyroid cartilage. The base of the cyst attached to the laryngeal wall was then partially opened and through this opening an internal cyst appeared, dilating on expiration and collapsing on inspiration. (Figs. 2A and B.) The internal cyst was firmly attached to the external cyst. The internal cyst had a wide neck, about 1 cm. in diameter. With gentle retraction of the hyoid bone and the thyroid cartilage enough exposure was obtained to resect both cysts. The internal cyst was resected at its neck and removed attached to the larger external cyst. The opening into the larynx was then closed with inverting continuous mattress sutures. The defect in the thyrohyoid membrane was covered by suturing the constrictor muscle to the edge of the thyroid cartilage. The wound was closed in layers with a Penrose drain brought out through the lower angle of the wound.

Grossly, the specimen consisted of a bulbous-shaped cyst, measuring 7 cm. in length and 4 cm. in its greatest diameter. (Fig. 3A.) The external surface was reddish in color and the wall of the cyst was thin. The inner surface was smooth and contained a yellowish secretion. The cavity of the cyst contained air. There was another small cyst, about 2 cm. in diameter, located at one pole of the larger cyst. This cyst wall was thin and the inner surface was smooth.

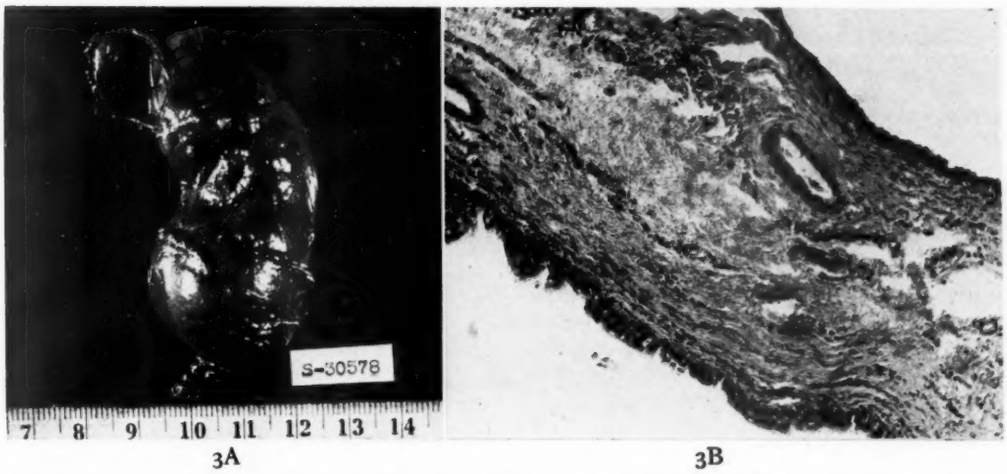
Microscopically, the lining of the laryngoceles showed layered ciliated epithelium in most areas. (Fig. 3B.) The walls of both cysts were composed of loose connective tissue with areas of perivascular lymphocytic infiltration. A few glandular structures were found within the walls, consisting of narrow acini lined by high columnar epithelium. There were some wider ducts lined with cuboidal epithelium and a layer of myoepithelial cells was present.

The patient's postoperative course was uneventful. The tracheotomy tube was removed on the fourth postoperative day. On the fifth day laryngoscopic examination revealed a slightly edematous and reddened epiglottis. The vocal cords were normal in color and motility. There was slight hypertrophy of the right ventricular band with marked visualization of the left vocal cord, indicating obliteration of the left ventricular



2A 2B

FIG. 2. A, operative appearance during expiration showing both internal and external laryngoceles. B, operative appearance during inspiration showing bulge of internal laryngocele into larynx.



3A 3B

FIG. 3. A, resected specimen showing intact external laryngocele and cut surface of internal laryngocele. B, microscopic section through the common wall between internal and external laryngocele showing epithelial linings of both sacs.

band. The patient was discharged on the fourteenth postoperative day with a normal voice.

SURGICAL TECHNIC

All authors agree that laryngoceles which produce symptoms should be excised. The external approach, parallel to the ramus of the mandible at a level between the hyoid bone and the thyroid cartilage, has been found to be adequate for external as well as internal laryngoceles. Various methods of exposing the larynx have been described in the literature. Some split the hyoid bone [*10*], others enlarged the opening in the thyrohyoid membrane by cutting the thyroid cartilage parallel to the midline [*16,17*], and some recommended laryngofissure [*21*]. It was found in the case reported herein that adequate exposure could be obtained by gentle retraction of the hyoid bone and the thyroid cartilage. The base of the transected internal laryngocele stalk should be inverted. The defect in the thyrohyoid membrane should be closed whenever possible and covered by muscle in an attempt to strengthen this weakness [*20*]. Tracheostomy is advisable for internal or combined laryngoceles. In the external type tracheostomy is usually unnecessary [*23*].

SUMMARY

A review of the history and literature of laryngoceles is presented. Ninety-six cases have been reported to date, approximately 50 per cent in the last ten years. Four cases

of combined internal and external laryngoceles are reported in the literature. The fifth case is presented herein. A simple classification of laryngocele is suggested. The surgical technic for excision of laryngocele is discussed, and an approach for combined laryngoceles without sectioning either the hyoid bone or the thyroid cartilage is presented.

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Medial Clefts of the Lips

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ACCORDING to Davis, a median cleft of the lower lip is more easily explained embryologically than such a cleft of the upper lip, but far fewer cases are reported in the literature. In recording a case he noted a total of six cases in the literature up to 1950 [2]. In 1952 Abramson [1] reported a case of bilateral cleft of the lower lip associated with other oral deformities. One such case, reported herein (Case I), was seen and surgically treated in 1951. There is a marked resemblance to a median cleft of the upper lip, such a case also being reported herein (Case II). This resemblance suggests that the formation of the lips is embryologically similar.

In both cases the presence of a broad frenum seemed to result from differential growth of mesodermal masses in the maxillary and mandibular processes. The mesodermal deficiency in the ectodermal tissue, representing developing lips, resulting in the cleft, may actually be a failure of mesodermal growth from a central mass—the premaxilla and the tongue-floor of the mouth analogue. The failure of growth may be partial, and is compensated by an overgrowth which represents the broad frenum from the tongue and the premaxilla, as seen in the midline cleft. The similarity of these clefts is well illustrated by the cases reported herein.

CASE REPORTS

CASE I. R. C., a fourteen year old white boy, was first seen on June 2, 1951, with the history of having a congenital cleft of the lower lip and having the tongue "cut away" at birth. Physical examination showed normal development except for the tongue, floor of the mouth, mandible and lower lip. The tip of the tongue was attached to a median cleft of the lower lip by a broad frenum, passing through a large diastema between the first incisor teeth of the mandible. The lip cleft extended beyond the vermilion border, and the frenum restricted the movement of the tongue. Speech was good, but facial grimacing was noticeable when he tried to produce the T, D and N sounds. A heavy patch of leukoplakia had developed on the mucosal surface of the frenum, as proved by a later pathologic report. All the mandibular teeth were labial and buccal to their corresponding maxillary teeth.

It seemed advisable to correct this deformity in two stages, the first being to excise the frenum and resect enough bone to restore occlusion of the teeth; and the second, to repair the lip cleft. Measurements were taken from models to determine the amount of anterior bone to be resected to bring the teeth into normal occlusion. A one-stage resection was planned because the degree of internal rotation subjected to the condyles did not appear to be excessive.

The first operative procedure was performed on July 18, 1951. The labial-lingual frenum was released and the central portion of the mandible separating the first incisor teeth was resected through an oral approach. The osteotomy site was wired directly and further supported by intermaxillary wiring of the teeth. The fixation was maintained for two months. The new occlusal relationship has not changed much in the ensuing years, except for a tendency toward an edge-to-edge bite anteriorly and a cusp-to-cusp relationship posteriorly. Orthodontic consultation suggested that this was due more to a predetermined class 3 occlusion than to tongue or condylar influences. (Figs. 1 through 11.)

CASE II. M. B., a nine year old white girl, was first seen at the Williamsport Cleft Palate Clinic on October 1, 1956, for treatment of a congenital median cleft of the upper lip. History and physical examination were normal, except for a median cleft of the upper lip, a broad maxillary-labial frenum, multiple additional frena of the maxillary and mandibular labial sulci, multiple papillomas of the tongue and a bilateral cross bite. It was recommended that the cleft, frena and papillomas be treated in two operative procedures, followed by orthodontic care to restore proper occlusion of the teeth.

The first operative procedure was performed

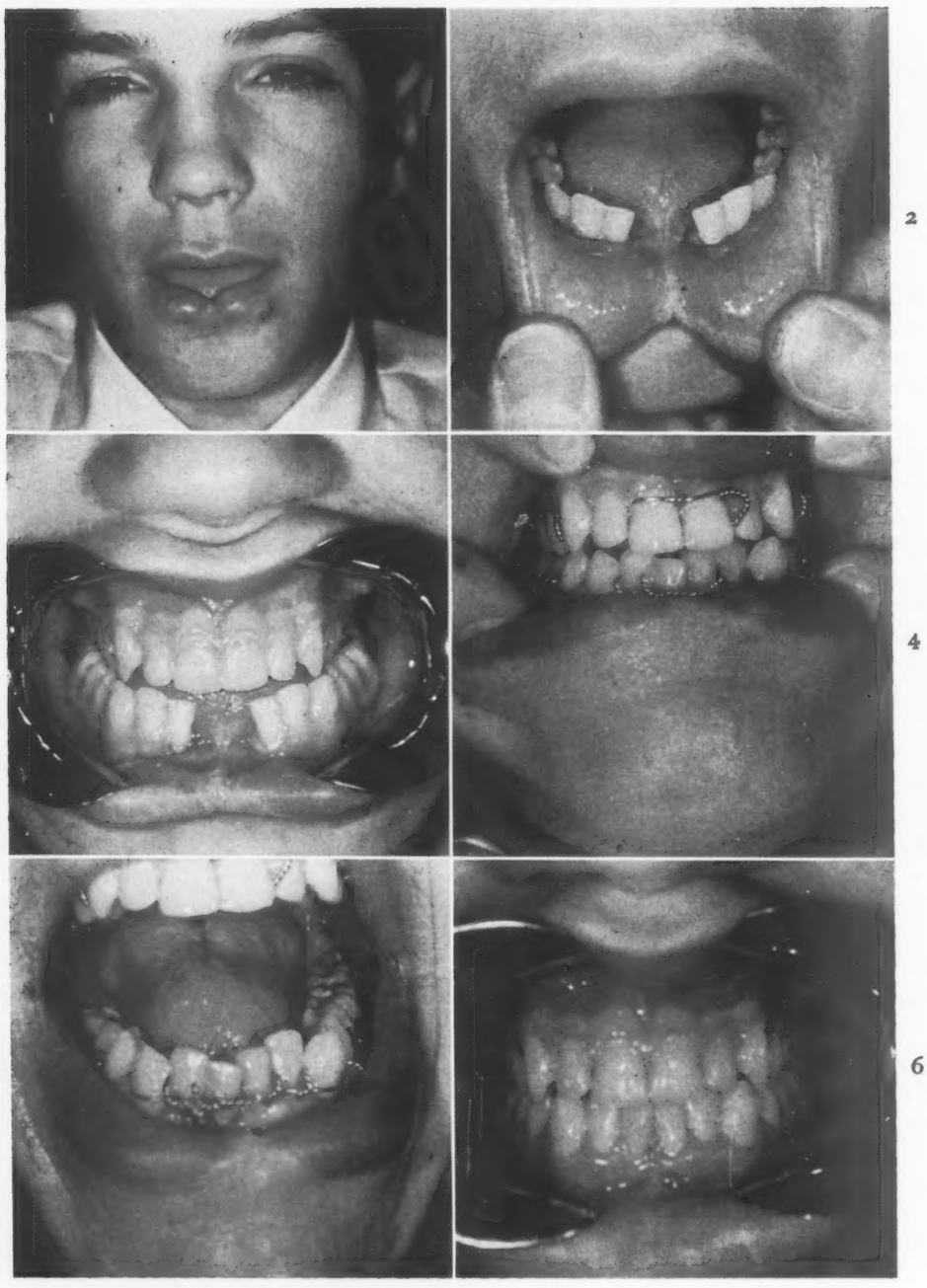


FIG. 1. Case 1. Median cleft of the lower lip.

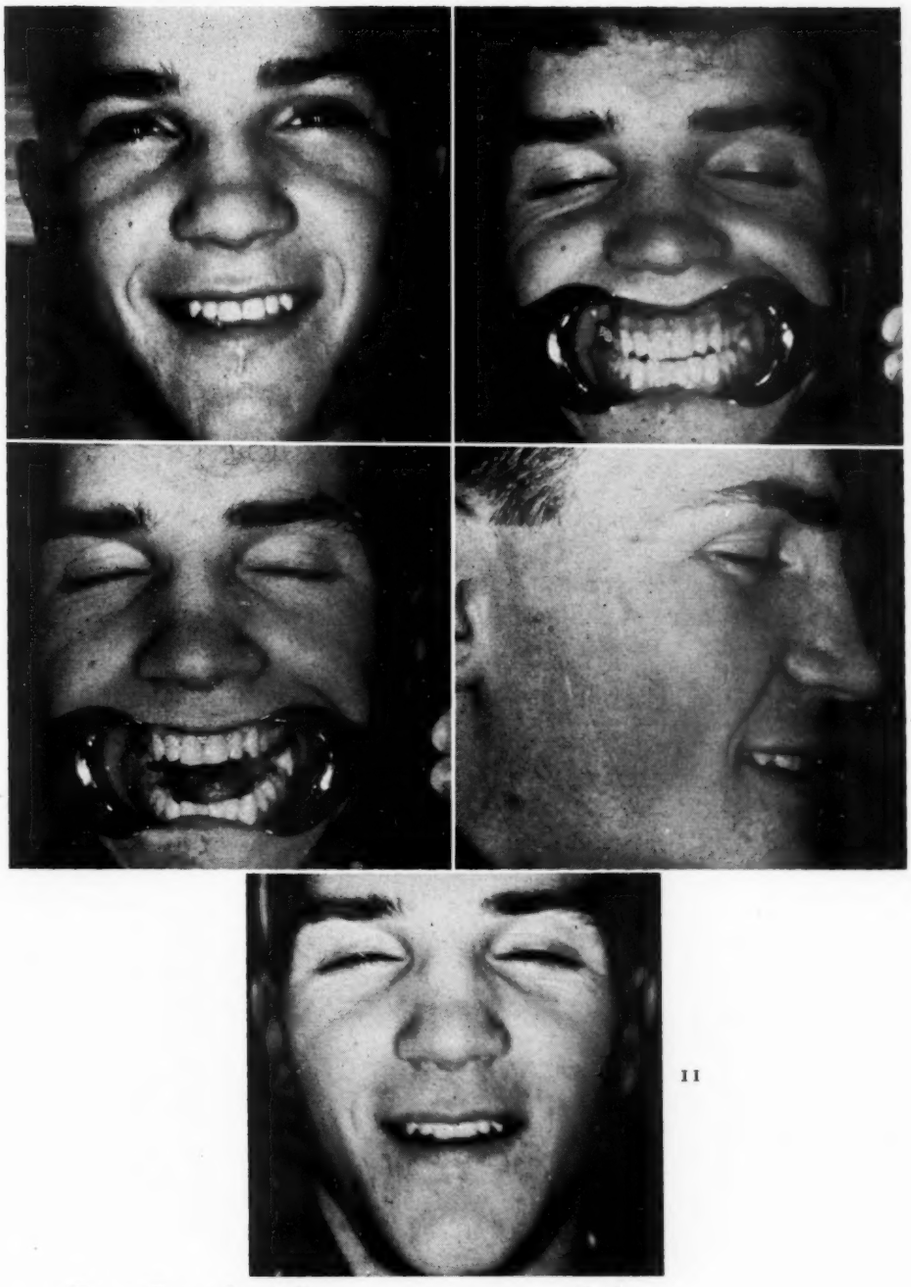
FIG. 2. Broad frenum from tip of the tongue to the lower lip cleft. Leukoplakia found on the frenum close to the lip cleft.

FIG. 3. Teeth in occlusion.

FIG. 4. Occlusion after removal of intermaxillary fixation wires.

FIG. 5. Function after removal of intermaxillary fixation wires.

FIG. 6. Occlusion six months after ostectomy.



7 8 9 10 11

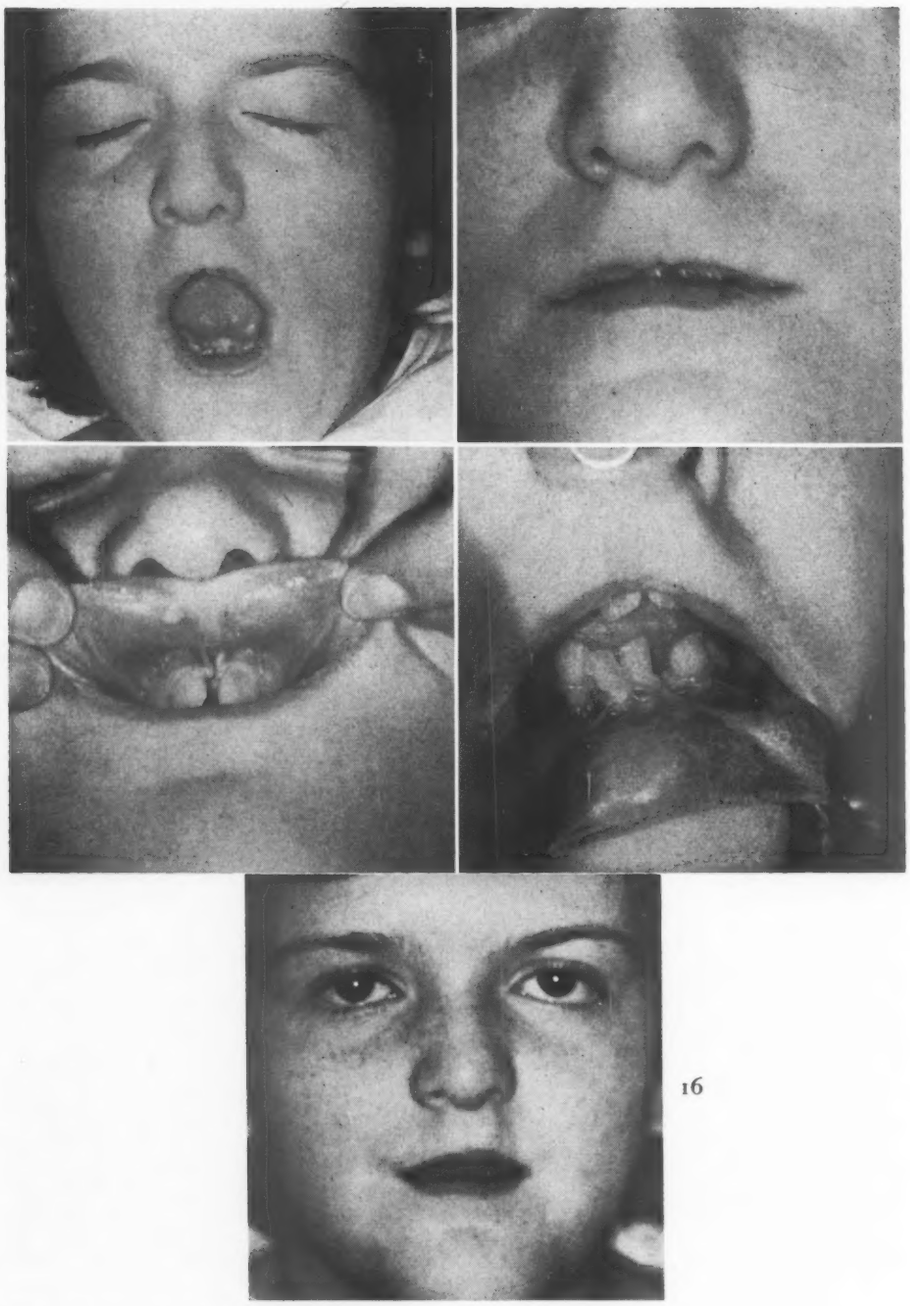
FIG. 7. Case 1. Lower lip scar one year postoperatively.

FIG. 8. Occlusion five years postoperatively showing a class 1 malocclusion.

FIG. 9. Function five years postoperatively.

FIG. 10. Obtuse angle of mandible five years postoperatively.

FIG. 11. Lower lip scar five years postoperatively.



12 13 14 15 16

FIG. 12. Case 11. Median cleft of the upper lip.

FIG. 13. Close-up of median cleft of upper lip.

FIG. 14. Frenum from the lip cleft to the incisive pad passing through a diastema between the first incisor teeth.

FIG. 15. Multiple mandibular frena.

FIG. 16. Postoperative lip repair.

on March 30, 1957. The broad maxillary-labial frenum was excised with the cleft tissue, and the defect was closed with multiple Z-plastic flaps to avoid a straight line closure. At the second operation, performed on July 18, 1957, the remaining maxillary and mandibular frena were eliminated by Z-plastic flaps. The lingual frenum crossed the mandibular ridge through a diastema between the first incisor teeth and formed a frenum in the labial sulcus, but there was no cleft of the lower lip. (Figs. 12 through 16.)

COMMENTS

Median clefts of the upper and lower lips in these two cases seemed to be related to a persistence of an ectodermal-mesodermal structure connecting the ectodermal hood of the lips to the ectoderm of the inner oral structures. If we are to accept the failure of mesodermal ingrowth into the ectoderm as the cause for clefts of the upper lip and hard palate [3–7], we could postulate that in these cases the ingrowing mesoderm became displaced to the frenum areas. This could result in a persistence of the frena in median clefts of the lips.

SUMMARY

Two cases, one representing a median cleft of the lower lip and one a median cleft of the upper lip, both associated with broad frena, are presented. The subsequent surgical management is also discussed, and a possible theory for the presence of the medial cleft is postulated.

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Pharyngeal Flap Staphylorrhaphy and Speech Aid As Means of Avoiding Maxillofacial Growth Abnormalities in Patients with Cleft Palate

A PRELIMINARY REPORT

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A BODY of opinion that early closure of a cleft palate causes serious abnormalities of growth of the middle third of the face and the dental arch has built up in the last thirty years. Were facial and maxillary arch growth the only factors involved, it might be wise to delay cleft palate closure until such growth had occurred. In fact, some concerned with the care of these patients have recommended putting off closure until age five or more, partly, at least, for this reason.

However, other factors are involved. Evidence that unclosed clefts or incompetent velopharyngeal mechanisms are accompanied by an increased incidence of upper respiratory tract infections, abnormalities of the nasal or nasopharyngeal mucous membranes and middle ear problems, including deafness, also has been accumulating. As long as an appreciable cleft remains unclosed or uncovered, the patient has little chance of developing normal speech or swallowing mechanisms.

Furthermore, controversies still exist concerning the roles of such factors as congenital lack of tissue and growth potentiality, the technic of closure and the type of cleft in the production of maxillary growth abnormalities. Most of those who believe that early surgical closure of palate clefts is responsible feel that the maneuvers carried out in the hard palate region are the ones most likely to cause interference with maxillary growth. But what is the effect of a close but tight, flat soft palate on collapse of at least the posterior segments of the arch? Almost all called upon to treat these patients agree that the cleft lip should be closed early in life. What is the effect on growth of the middle third of the face of the sheet of scar produced in undermining the cheeks as an aid in closing the lip cleft? What occlusal difficulties result from the taut lip pressing on the anterior portions of the arch? It must be admitted that answers to questions like these are unavailable or still disputed.

The present position of those treating patients with a cleft lip or cleft palate at our clinic is that almost certainly some of these patients are born with abnormal maxillary growth potentialities. We suspect that (1) the tighter the lip is draped over the alveolar process, (2) the thicker the cheek scar is and (3) the larger the area that the sheet of cheek scar covers, the more impedance of growth there will be. We suspect that the tighter the closed soft palate is, the more likelihood there is of mesial displacement of the posterior parts of the maxillary arches. We suspect that the more extensive the scar between the mucoperiosteal flaps and the bone of the hard palate is, the greater the effect will be on growth. We further suspect that the earlier

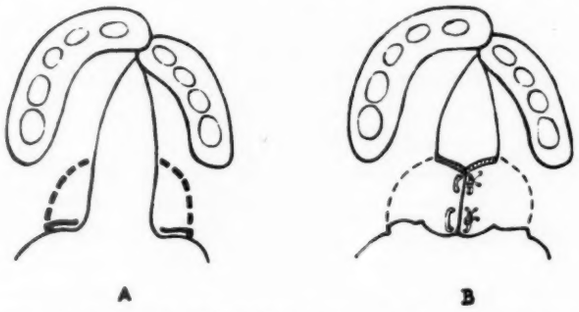

FIG. 1. Views of cleft palate from oral side. A, incisions made in nasal side of soft palate to produce the leaf of book palatal flaps. B, palatal flaps turned over and sutured to each other near midline. Dashes indicate extent of raw surface facing nasally.

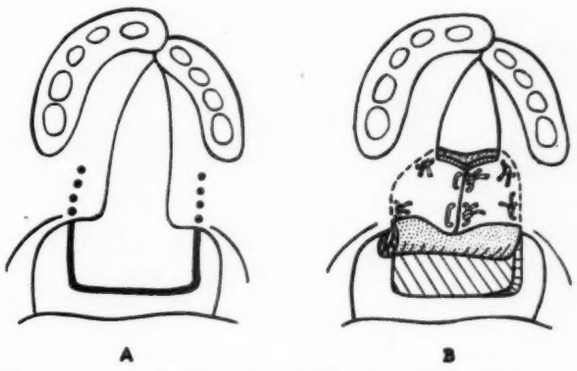

FIG. 2. A, incisions in posterior pharyngeal wall outlining posterior pharyngeal flap based nasally or superiorly. B, pharyngeal flap attached to raw surfaces of palatal flaps and their donor areas. Pharyngeal flap donor area also shown.

the hard palate closure is done, the more total effect on growth there will be. However, we are convinced that long delayed closure exacts its penalty in respiratory tract changes and otological problems. Furthermore, in our experience, the effects of delayed successful closure of clefts and establishment of a competent velopharyngeal mechanism carry over into school performance and, put mildly, are not welcomed by the rest of the family.

Our earlier work with the posterior pharyngeal flap palatorrhaphy led us to wonder whether this procedure combined with the use of a dental appliance might not provide a means for obtaining further knowledge of the effects of delayed as contrasted with early closure of a hard palate cleft. The dental appliance could be used to cover the surgically unclosed hard palate cleft. The posterior pharyngeal flap staphylorrhaphy could be used early to obtain closures of a soft palate cleft. Thus, for practical purposes, the cleft palate could be "closed" early with no surgery having been performed in the hard palate region.

In the posterior pharyngeal flap staphylorrhaphy, two flaps based on the cleft edges are elevated from the soft palate, turned over and attached to each other. (Fig. 1.) A flap elevated from the posterior pharyngeal wall is attached to their raw surfaces and the palatal flap donor areas. (Fig. 2.) In this way almost all of the soft palate cleft can be closed without lateral relaxing incisions, detachment of the palatal aponeurosis, fracturing of the hamular processes, or the leaving of uncovered raw surfaces on the palate to heal by granulation and contraction. None of the bone of the hard palate is exposed, and no instrument goes near the important neurovascular supply to any of the hard palate growth centers. In many patients younger than age two, the remaining cleft can be covered with an acrylic appliance sufficient to separate the nasal cavity from the oral cavity.

It was hoped that this combined surgical and non-surgical approach would prevent many of the undesirable effects of delayed closure and help us learn, by comparison with early surgically closed hard palate clefts, what really are the growth sequelae of early operations for hard palate clefts. Moreover, if early surgery on the hard palate actually does produce serious occlusal and maxillary growth abnormalities, it was hoped that this attack might be of real therapeutic value in preventing these.

Our palate team consists of dentists, physicians and their helpers. An endotracheal tube is passed through the mouth, ether and oxygen are administered, the patient is placed in the Rose position, impressions are taken, measurements are made, any restorative dentistry or extractions are performed, selected teeth are banded, and the posterior pharyngeal flap staphylorrhaphy is performed. After the impressions are taken and during the performance of the other measures just mentioned, an acrylic appliance is constructed. At the end of the procedure the appliance is ready and is placed in the patient's mouth. (Fig. 3.) Any minor changes needed in it are made at that time. The appliance is removed and the patient is returned to his

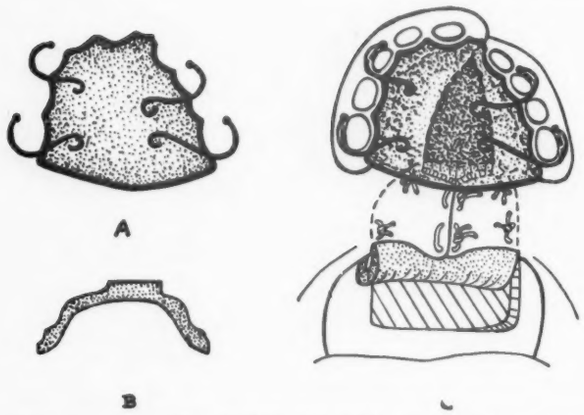

FIG. 3. A, acrylic speech aid with buccal wires seen from oral side. B, cross section of (A). Note uniform thickness and peripheral post-dam around the cleft opening to permit sealing of the speech aid. C, seated speech aid with buccal arms attached to edgewise bands. Note extension of acrylic beyond opening of cleft posterior to the unclosed hard palate cleft.

room. Thus, in one period of anesthesia, many maneuvers are performed conveniently under the best of conditions.

This report must be considered a preliminary one in that many years of follow-up will be required before the effects on palatal, maxillary and facial growth can be determined. Also, a large series will be required to allow intelligent evaluation. However, we are presenting this approach at this time in the hope that certain of those in other palate centers eventually will use a similar approach and thus allow an earlier adequate evaluation.

Our first patient was operated upon in 1956. There have been a total of eight patients whose parents have accepted this approach to date. The youngest patient was seventeen and a half months old when the procedure was performed; the oldest, twenty-seven months. There has been no selection of cases, the clefts being complete and incomplete, bilateral and unilateral, and in both sexes.

The posterior pharyngeal flaps were based superiorly or nasally in six of the patients, inferiorly or orally in two.

All patients have been followed up carefully to date. In all, the hard palate clefts have narrowed since surgery. While there have been a few upper respiratory tract infections and mild middle ear infections, our impression is that there have been fewer of these after surgery than were reported in the same patients before their procedures were performed. All show improvement in the handling of food and liquids. Four of the patients have had no difficulties with the plastic appliance covering the hard palate cleft. In four, there have been some fitting, irritation or retention problems. None of these do we deem serious enough to require the selection of another therapeutic approach.

It is too early to even form a worth while opinion as to speech progress. However, our general impression is that these children are doing at least as well speechwise as those whose clefts have been closed at the same ages with the usual methods.

Therefore, we have found no evidence yet indicating that this combined approach is not a good one. It has certain theoretic advantages which, we believe, should be further investigated. We plan to delay surgical closure of the hard palate clefts until the child is between the ages of five and eight, or even longer, unless complications unknown to us at present arise. It is our hope that certain others will adopt this method and perhaps help in getting answers to several questions which have plagued those concerned with cleft palate therapy for many years.

The Rationale of Early Expansion of the Maxillary Arch in Patients with Cleft Palate

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EARLY orthodontic expansion of the maxillary arch in the child with a cleft palate is designed to place the maxillary bones, and hence the alveolar ridges, in proper buccolingual relationship to the mandible. The particular technic which will be described has been in use at the Children's Medical Center, Boston, for the past four years. The general philosophy of early treatment is rapidly regaining acceptance in orthodontic circles and has been reported by others [*1,2*].

To discuss the procedures of orthodontic treatment without defining the surgical approach would be pointless. In fact, it should be pointed out that we have found this early method of treatment a valuable adjunct to our surgical program. At the Children's Medical Center palates are repaired when the child is approximately fourteen months of age, if he has reached a weight of 20 pounds and is in satisfactory general condition. MacCollum et al. have described the procedure of surgical repair as follows [*3*]:

"The repair of all these cleft palates has followed a similar pattern. First, the edges of the cleft are freshened by excision of a narrow rim of tissue. Bilateral relaxing incisions are then made. These start outside the alveolar ridge of the lower jaw, extend across the commissure between the upper and lower jaw and then continue inside the alveolar ridge of the upper jaw running as far anteriorly as is thought necessary. In a complete cleft palate with alveolar defect, the anterior end of the incision usually stops just inside the lateral incisors. Mucoperiosteal flaps are then elevated, and the descending palatine vessels are isolated and carefully preserved. To obtain sufficient freedom of the palatal flaps, the vessels are stretched from their foramens, as robins pull angleworms out of a hole in the ground. Each hamulus is identified, and the tensor palatine muscles stripped off the end of it. The hamulus is broken and is angulated medially at its base. The nasal mucosa with its fascial attachments is cut after it has been freed from the nasal surface of the palatal bones. The edges of the palatal cleft are then brought together with alternating single and mattress sutures of No. 00000 chromic catgut to the nasal surface and buccal surface. Plain catgut (No. 00000) is used for the submucosal portion of the uvula. It is believed that the success of a good repair depends largely on wide and extensive mobilization of the tissues so that there is no tension whatever on the palatal flaps and, perhaps even more important, on extreme gentleness in the handling of this tissue."

It is not within the scope of this presentation to review the pros and cons of early versus late repair of the palate [*4,5*]. An important consideration for early correction at the Children's Medical Center is that the palate is reconstructed before the child learns to speak. We are satisfied that the speech and the over-all development of these patients is good [*3,6*].

When we consider the incidence of cleft palate—one child in every 800 live births [*7*]—it is comforting to note that many of these patients have incomplete clefts. Our examination [*6*] of 111 children with cleft palate several years after surgical repair revealed that patients in Veau's classes I and II had the potential for the development of ideal dental and facial relationships as well as all types of malocclusions. One must

1 2

FIG. 1. Severe maxillomandibular discrepancy in a fourteen year old patient.

FIG. 2. An anterior cross bite affecting mandibular alveolar bone and axial inclination of lower incisors.

remember the fact that the child with a cleft palate has this congenital defect superimposed on a substrate no better than that of the average population, and that most factors producing malocclusions in the general population are also influencing his growth and development.

In patients whose clefts do not traverse the alveolar ridge, the incidence of cross bites approximates that of the average population. In complete clefts the incidence is much higher or, stated another way, the bony continuity of the maxillae and premaxilla is of paramount importance in the normal formation of the mid-part of the face and oral cavity.

Surgical repair and subsequent scar contractures are referred to in explaining maxillomandibular discrepancies. Presently more and more emphasis is being placed on the normal contraction of the musculature of the lips and cheeks. Abnormal function and tonus in this area is certainly important in many types of malocclusions associated with neither cleft lip nor palate. We have observed, and it has been reported [*8*], that complete clefts are often wide open anteriorly prior to lip repair. The typical collapse and cross bite relationship may be produced following correction of the lip, but this is prior to surgery on the palate.

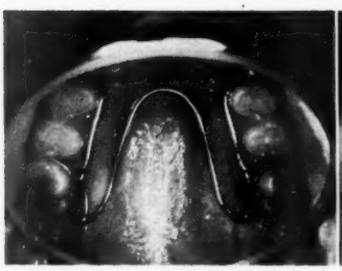
To overcome maxillary collapse, which in severe cases may lead to the type of malocclusion seen in Figure 1, early orthodontic expansion is undertaken to regain normal configuration of the maxillary components. Orthodontic treatment for this patient (age fourteen) may be of limited benefit and of uncertain prognosis. It should be noted that the bite here is already open, that is, the upper teeth fail to make occlusal contact with the lower teeth in the vertical plane. Does the position of the tongue implicate it in the lack of vertical growth in this displaced alveolar process?

Tooth movement alone cannot produce a functionally balanced occlusion in this type of patient, for the bony base is at fault. Buccal movement of teeth generally opens the bite. Tipping these teeth outward will decrease their resistance to occlusal stress, particularly when these same teeth may be called upon to function as abutments for prostheses replacing missing teeth.

Teeth in cross bite create dental interferences which, if not correlated, can result in greater disharmonies in the developing alveolar bone. Figure 2 shows a patient with a long-standing cross bite of the permanent anterior teeth which has resulted in forward tipping of the lower incisors. This type of interference should be prevented. We can only intimate what effect it has had on the optimum growth potential of the premaxillary area.

It is convenient indeed that a sutural response can be achieved utilizing orthodontic forces transmitted to the bone via the teeth [*9*]. The Arnold appliance [*10*] currently used has certain limitations for adjustments not inherent in the Porter arch [*11*] which lends itself ideally to the problem at hand. The basic pattern of the Porter arch is illustrated in Figure 3. It is attached to cemented molar bands and can be removed by the orthodontist for adjustments with ease. It is simple in design, self-cleansing and comfortable for the patient. Since the working loop is well back on the palate, children rarely tamper with it and, therefore, breakage is rare.

Bilateral expansion is achieved by opening the loops at points A, B, and C. An outward rotation of the distal segments is facilitated by adjusting at point A or B only. For maximum sutural response, the periodontal environment of individual teeth should not be disturbed. Thus, for rotations, adjustments must be made distal to the appliance's attachment to the molar bands (A or B) so that the teeth in the segment are moved as a unit. Once the alveolar segment has undergone the desired correction, individual teeth can be regulated as is shown in Figure 3. Here the anterior ends of the appliance actively engage the first premolars.



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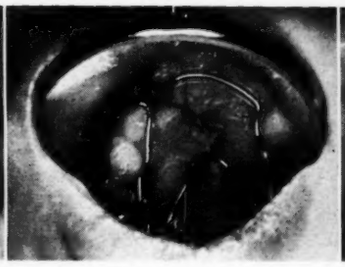

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FIG. 3. Basic pattern of the Porter arch.

FIG. 4. The Porter arch modified to engage the anterior teeth.

FIG. 5. Left posterior cross bite associated with a left unilateral alveolar cleft.

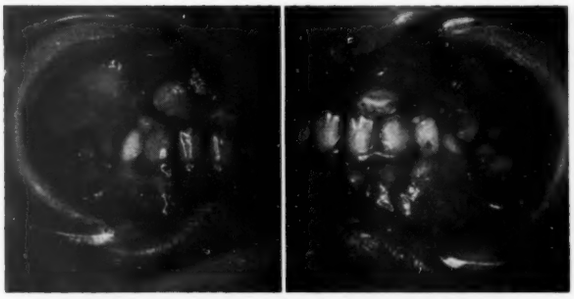


FIG. 6. Right and left posterior cross bite associated with bilateral cleft lip and palate in a nine year old patient.

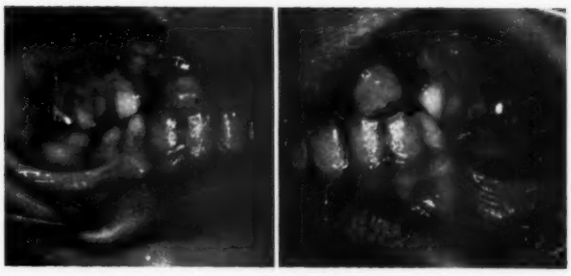


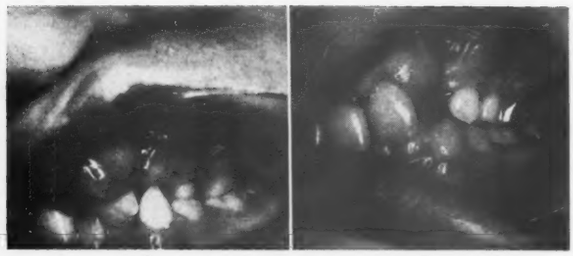
FIG. 7. Patient shown in Figure 6 after eight months of therapy with the Porter arch.

A common modification of the appliance is shown in Figure 4. The arch wire on the intact side continues forward to engage the anterior teeth. This increases stability for rotation of the distal segment and also makes possible labial movement of the incisors. The appliance contacts a maximum number of teeth although maintaining simplicity of design. To engage the badly displaced deciduous lateral incisor would not increase the forces transmitted to the bone sufficiently to justify the necessary compensatory bends in the wire.

The posterior cross bite associated with a left unilateral alveolar cleft is shown in Figure 5. Correction can be accomplished rapidly (three to six months) and at as early an age as three and a half years. If the anterior teeth indicate a pending anterior cross bite of the permanent teeth, the posterior correction is postponed until the permanent incisors have erupted, in the interest of economy and efficiency of treatment. In general, it would be safe to say that the ease with which the bony segments respond to these forces varies inversely with age. However, surprisingly good results can often be attained immediately prior to the shedding of the deciduous canines and molars (age nine to eleven). Postponing treatment to this age group is not recommended.

Figure 6 depicts the right and left sides of a bilateral posterior cross bite associated with a bilateral cleft lip and palate in a patient nine years of age. The results of eight months of expansion are shown in Figure 7. Following completion of the desired movement, the Porter arch is left in place to act as a retainer. Lacking alveolar continuity, dental interdigitations are not sufficient to maintain correction. Relapse of the favorable correction does not occur, however, during the transition to the permanent dentition. The support attainable through the first permanent molars is probably significant in this respect. Following completion of the permanent dentition, individual teeth are aligned and necessary replacements made.

Considerable expansion with a minimum of rotation was necessary in a case of left unilateral complete alveolar cleft. (Fig. 8.) Figure 9 shows the patient's left side nine months later. The maxillary first permanent molar has erupted in good position without orthodontic intervention. In this case the mal-



8 9

FIG. 8. A unilateral posterior cross bite in the mixed dentition. Left unilateral alveolar cleft.

FIG. 9. Porter arch correction achieved nine months later for patient shown in Figure 8.

posed left permanent central incisor required attention early because of the irregularity it was causing in the lower arch.

It might be said that in the interest of economy it is important to delay the initiation of treatment as long as possible since these patients cannot be considered fully treated from the orthodontic standpoint until all permanent teeth have erupted and have been put in order. However, we cannot afford to gamble with the end result and should, therefore, intervene whenever there is a threat to optimum growth and development. Actually, it would seem that total treatment time will prove to be shorter although running over a longer period of time. Also, it is hoped that this technic will yield a consistently more favorable prognosis for this phase of treatment in the total care of the child with a cleft palate.

SUMMARY

1. The objectives and advantages of early treatment are discussed as the orthodontic approach to patients whose cleft palates are repaired surgically at an early age.

2. Bone repositioning by means of the Porter arch is illustrated.

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Prevention of Functional Deformities in Surgery for Prognathism

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A PIONEER in surgery for prognathism was Hullihan, who in 1848 performed a partial osteoplastic resection of the jaw for excision of a scar caused by a burn. Blair apparently performed a resection of the body of the mandible in 1898 as advised by Angle. To Blair goes the credit for being the first to develop a *practical* technic for the correction of this state. He devised a horizontal osteotomy of the ascending ramus in 1907 and to this day this procedure is commonly performed.

Prognathism is a condition of protrusion of the jaws, either maxillary or mandibular. This paper is concerned with the mandibular type. (Fig. 1A, B and C.)

Mandibular prognathism can exist with protrusion of the lower arch and symphysis and an obtuse angle to the angle of the horizontal and ascending ramus. This obtuse state is usually associated with an elongation of the ramus. Variations in degree of this condition are common and the type of surgical therapy should depend on the exact anatomical relationship present.

Many operative approaches have been discussed in the literature indicating both a variation in opinion and variations in anatomical relationships all termed prognathism.

Many successful and unsuccessful procedures have been described: ostectomy of the body of the mandible, osteotomy of the angle of the mandible and ostectomy of the angle of the mandible. More recently submandibular notch ostectomy and condylotomy have been advocated by Smith and Robinson. Subcondylar osteotomy has been suggested by Heinz and other writers, and bilateral partial condylar ostectomy has been recommended by Dufourmental and modified by M. Gonzalez-Ulloa. Each author has presented the

1A 1B 1C

FIG. 1. Preoperative appearance of mandibular type of prognathism. A, frontal view. B, left profile. C, right profile.

indications for the operation of his choice. Some authors believe that their procedure covers all conditions and that there should be only one procedure of choice. The consensus, however, is that the varied anatomical states require varied approaches. We have been performing our procedures depending on the dental occlusal relationship of the maxillary and mandibular teeth, the maxillary and mandibular bone length and the angulation of the ascending ramus. If the anterior-posterior dimensions of the mandibular dental arch are greater than the maxillary dental arch, we elect to perform ostectomy of the mandibular body. If, however, the arch relationship anteroposteriorly between the mandible and the maxilla is similar in size, we choose the horizontal ramus for a sliding osteotomy.

The purpose of this paper is to discuss only those cases which the surgeon has selected for horizontal bilateral osteotomy of the ramus.

Certain factors exist that produce failures in all types of cases. The main complications and causes of failures are: (1) failure of union due to the malrelationship of the surgically fractured parts, and (2) open bite. The causes of these conditions are primarily: (a) improperly selected surgical approaches, (b) muscle imbalance due to the new position of the muscles caused by the change of position of the fragments and (c) improper stabilization. The prevention of (a) is self-explanatory. Muscle imbalance can be partly overcome by direct bone wiring of the severed bones in their new position as well as proper ligation of the dental arches. In many cases, however, this direct bone wiring does not seem to solve the problem completely and open bite may result. Many writers have suggested that muscle imbalance is still the major factor involved in open bite. It is our belief that this is the primary cause, and this paper is concerned with an attempt to prevent this condition from occurring.

In performing horizontal osteotomy of the ramus, the external pterygoid muscles and the temporal muscles are not involved as the proximal fragment does not move. The internal pterygoid and the masseter muscles, however, are involved in the new change in position of the distal fragment. It would be wise at this time to review the anatomy of these muscles.

The internal pterygoid muscle arises from the inner surface of the lateral pterygoid process (the pyramidal process of the palatal bone) and the maxillary tuberosity. Its fibers extend inferiorly, posteriorly and laterally, and insert on the mandible at the medial surface of the angle and the medial surface of the ramus up to the inferior alveolar foramen. The muscle elevates the mandible and assists in the medial and anterior movements of the jaw.

The masseter muscle has deep fibers originating on the medial surface and posterior part of the inferior border of the zygoma, extending inferiorly and anteriorly and inserting into the superior half of the lateral surface of the ramus and coronoid process of the mandible. The superficial fibers originate from the lateral and anterior two-thirds of the inferior border of the zygomatic arch, extend posteriorly and inferiorly, and insert into the lower half of the outer surface of the ramus and angle of the jaw. This muscle is an elevator of the mandible and assists in the protrusive motions of the jaw.

Many writers have described these muscles as the cause of open bite. This feeling has come about because these two muscles are extremely strong and are displaced with a change in position of the distal fragment of the mandible in horizontal osteotomy of the mandible. The fibers of these muscles prior to surgery run posteriorly from above downward. In performing horizontal osteotomy of the ramus, the entire distal fragment of the mandible is displaced posteriorly and these two muscles are placed on a stretch due to the posterior movement required of the distal fragments. In cases of marked prognathism posterior movement requirements are great and upward displacement of the distal fragment can occur, resulting in downward displacement anteriorly and an open bite. This does not occur in all cases but is more common when posterior displacement is great, when immobilization is poor or when immobilization is maintained for too short a period of time. With this in mind it becomes apparent that this situation might be prevented by resecting the distal fibers of both of these muscles bilaterally. After resection and repositioning of the distal fragment they may be repositioned to the mandible in an angle similar to that existing prior to surgery.

This procedure has been used in four cases with good results. The first patient was operated upon in 1948 and the last in March, 1958.

One of these cases is discussed herein because of its particular interest. This patient had multiple congenital deformities: cleft palate, torticollis, scoliosis, prognathism, underdevelopment of the maxilla and unilateral slight overdevelopment of the mandible on the right side.

FIG. 2. Preoperative view showing poor oral status and short rigid palate.

CASE REPORT

M. F., a twenty-seven year old white woman, had had two operative procedures performed upon her palate as a child in Boston. Her speech was almost unintelligible and her palate was closed but posteriorly it was extremely short and functioned poorly. (Fig. 2.) She had a moderate degree of maxillary underdevelopment. The anterior maxillary teeth were intact but badly carious; one right second premolar was also carious. Her mandible was prognathic, edentulous and had an obtuse gonial angle. It was also moderately asymmetric with an overdevelopment on the right side in the region of the body. It was decided that bilateral horizontal ramisection with direct bone wiring and transposition of the internal pterygoid and masseter muscles bilaterally was indicated. It was also believed that a pharyngeal flap would improve her speech. We elected to perform both procedures at one operation by performing preliminary tracheotomy at the start and administering the anesthesia through a tracheotomy tube. We believed that this would protect the patient postoperatively in case of edema and/or hemorrhage. It would also allow us to close the jaws firmly in the new position with the patient under general anesthesia. It was further decided that the pharyngeal flap should be the first part of the procedure, to be followed by the ramisection.

Mandibular and maxillary splints were constructed with an attached Winter labial arch bar to the mandibular splint. The maxillary teeth were cleaned and maxillary labial arch bars were wired to them. The splints were constructed of acrylic on a Hanau articulator. X-rays were taken and the angle of cut of the rami was planned. (Fig. 3A and B.)

The patient was anesthetized and an endotracheal tube was passed. Low tracheotomy,

FIG. 3A. Preoperative x-ray showing marked prognathism.

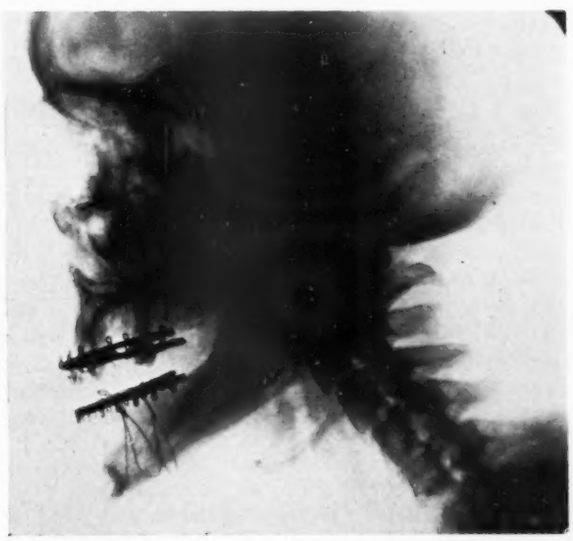


FIG. 3B. Postoperative x-ray showing new position of jaws wired.

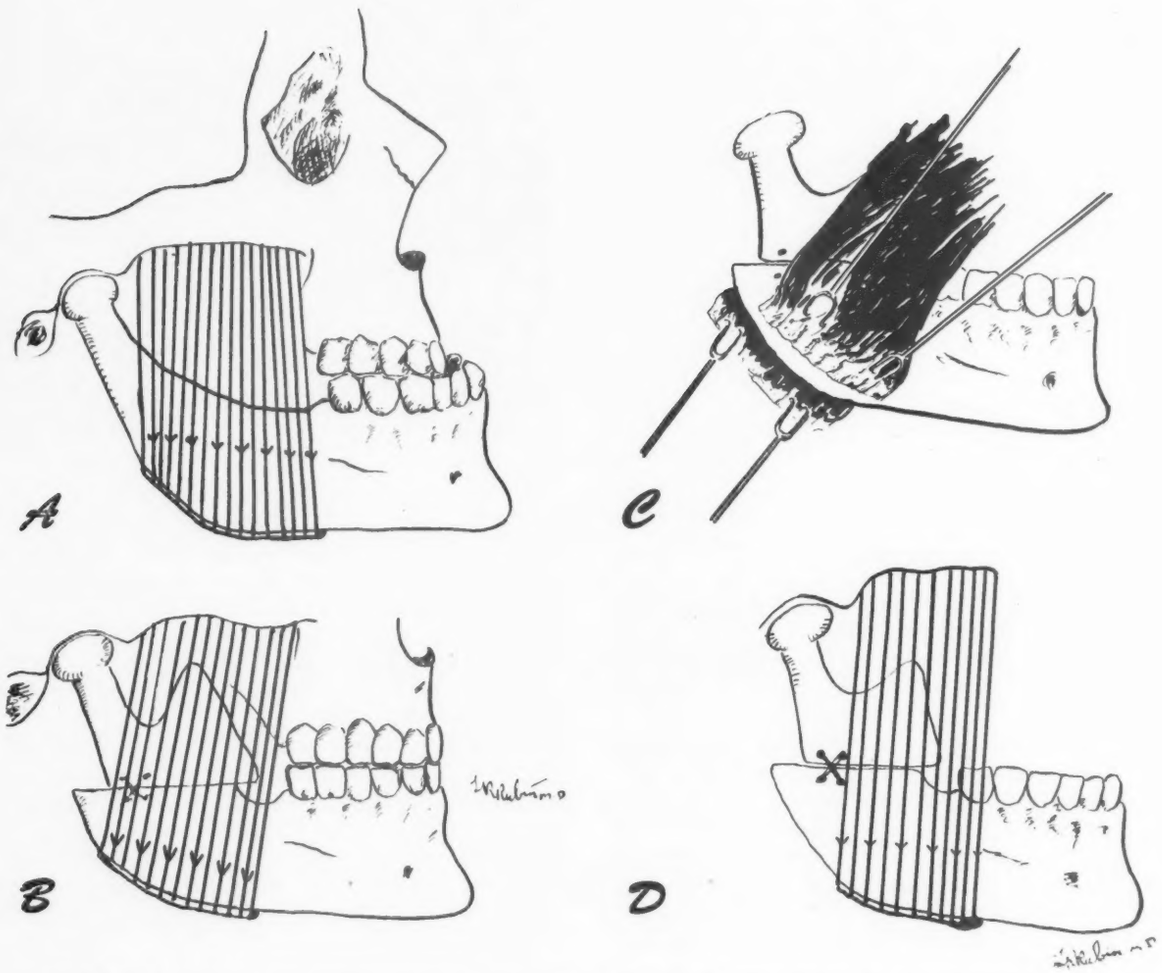


FIG. 4A to D. A, prognathism, preoperatively. Note angle of masseter muscle fibers. B, postoperative routine horizontal ramisection. Note posterior angulation of masseter (and internal pterygoid) muscle fibers. This tends to place an anterior pull on the mandible which may result in an open bite. C, surgical resection of distal end of masseter and internal pterygoid muscle fibers. D, muscles repositioned at same angle as fibers in (A), allowing for no abnormal anterior pull.

using a horizontal incision, was performed and a No. 5 tube inserted as the endotracheal tube was removed. Anesthesia was continued through the tracheotomy tube by way of an adapter which fit into each tracheotomy tube.

The patient's head was placed in the Rose position and a posterior wall pharyngeal pedicle flap was raised, based superiorly. The posterior velum was split in the midline and a pocket, 2 cm. wide, was made in the posterior border between the nasal and oral layers. The flap was sutured into the pocket* with No. 5-0 silk vertical mattress sutures. Two No. 4-0 chromic sutures were placed on the donor site of the pedicle and the patient was reprepared and draped with the head in a normal position on the table. Bilateral horizontal osteotomy of the rami was performed with a slight angulation of cut (about 20 degrees). The cuts were made above the lingula and below the sigmoid notch. One burr hole above and below the cuts was made bilaterally after the body of the mandible was displaced posteriorly in the required position. The distal ends of the internal pterygoid and masseter muscles were freed of the bone and on their ends was placed one No. 2-0 chromic suture with a needle on the end. One 25 gauge stainless steel wire was passed through the fragments into the burr holes and the fragments were stabilized in the new position. Small burr holes were made in the lower border of the mandible at a point

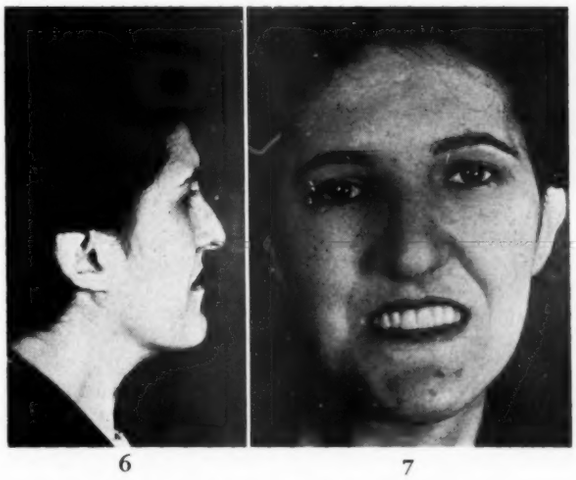
* The technic of using a pocket in the posterior velum wall has been used by us in over seventy cases of pharyngeal flaps. This was worked very simply and effectively and the "buried" epithelium at the superior aspect of the flap in the pocket has never caused a problem.

FIG. 4E. Posterior view showing inferior attachments of masseter and internal pterygoid muscles.

FIG. 5. Postoperative view showing posterior pharyngeal flap and new dentures.

where reattachment of the muscles was desirable. This point was one that positioned the muscles at the same angle as existed preoperatively. (Figs. 4A to E.) No. 4-0 chromic sutures were passed into the muscles and bone in one loop and the muscles were allowed to remain in this position. The skin incisions were closed in layers using No. 4-0 plain catgut to the subcutaneous tissue and No. 6-0 silk for the skin. The mandibular splint was positioned on the mandible with 25 gauge stainless steel circumferential wires. The maxillary and mandibular arch bars were wired together in a planned position. Sterile pressure circular head dressings were applied making sure to clear the tracheotomy opening.

The patient had a relatively benign postoperative course with moderate bilateral facial edema. The tracheotomy tube was removed in forty-eight hours and the patient was kept on a high protein, high calorie, high carbohydrate, high vitamin liquid diet. Six hundred thousand units of crystalline procaine penicillin was given twice a day for one week. The patient's jaws were wired for six weeks and then the intermaxillary wires were removed. One week later the circumferential wires were removed when it was believed that the position was being maintained. The patient's speech was markedly improved and easily understood. The jaws continued to maintain their new position. The rather poor maxillary teeth were extracted and a full maxillary and mandibular denture was inserted by her dentist. (Figs. 5, 6 and 7.) This helped to maintain the position well. She has been followed up continuously for two years with maintenance of the same position. Her speech has continued to improve remarkably although no speech therapy has ever been given to her. The pharyngeal flap has tubed itself



6 7

FIG. 6. Right profile postoperatively.

FIG. 7. Frontal view postoperatively.

nicely and is holding very satisfactorily. There is a marked cosmetic and social improvement. The function of her jaw is excellent and she can chew very well. The lateral and protrusive motions of the mandible are normally performed.

SUMMARY

In cases in which bilateral horizontal ramisection is indicated for prognathism, it is believed that open bite can be prevented by reattachment of the masseter and internal pterygoid muscles bilaterally. This prevents stretching of these muscles. Four such cases have been successfully treated with a follow-up as long as ten years in one case with no open bite in any case. One case is discussed in which this procedure along with a pharyngeal

flap and tracheotomy for anesthesia were simultaneously performed.

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The Surgical Treatment of Edentulous Prognathic Patients

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IT is usually unnecessary to operate upon persons who have a prognathic, edentulous mandible. A prosthodontist is able to construct good functioning dentures which will solve the problem of mastication and sometimes better their appearance [*1*]. However, there are cases which are exceptions to this rule and these will be discussed herein. They fall into two main categories: (1) the person who has a long and wide mandible associated with an extremely small maxillary arch so that functioning dentures are impossible and (2) the person who can have functioning dentures constructed but whose appearance is so abnormal that cosmetic improvement is desired.

Four cases are to be presented illustrating various problems and showing the surgical procedures that were chosen to correct them. There are, in general, two main principles employed in the correction of a prognathic jaw [*3–5*]. One is section of the ascending rami above the mandibular foramen or condylectomy permitting the whole jaw to be pushed posteriorly into a predetermined position [*1,2*]. The other is to remove a premeasured section from both sides of the body of the mandible permitting the anterior part to move posteriorly where it is united and held in position by some means of fixation [*6*]. (Figs. 1, 2 and 3.) The former method is used principally in dentulous persons who have a good complement of teeth which may be placed in proper alignment with the uppers and thus create a near normal bite. When the latter is employed in a dentulous person one or two teeth must be sacrificed on both sides, so it is not the procedure of choice in such a case. In the edentulous person teeth are no problem, so removing sections from the body of the mandible is an ideal way of not only shortening but also narrowing it if it is advisable to do so.

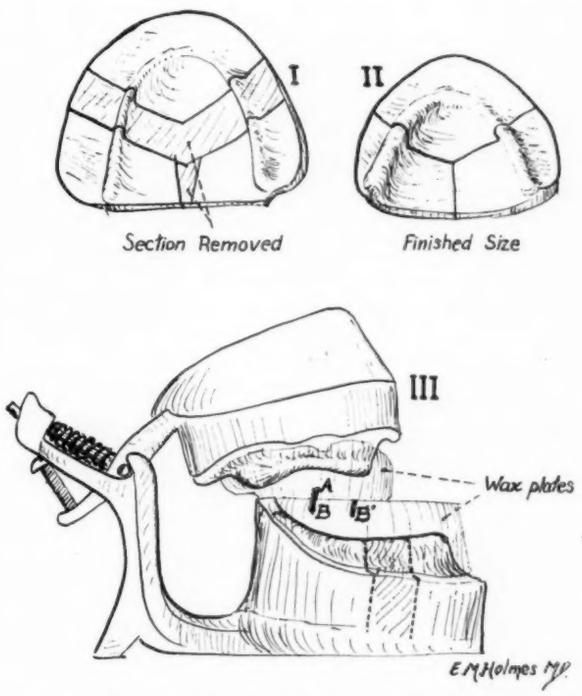

FIG. 1. Mandibular model. I, a plaster model of the mandibular alveolus. The cross hatched area is the section which was removed to permit the jaw to be shortened and narrowed. II, the alveolus after "surgery" on model. III, plaster models of the upper and lower jaws mounted on an articulator as they were prior to operation. The marks (A) and (B) on the wax plates indicate the actual preoperative positions. When the upper model is brought forward and a desired relationship is obtained, another mark (B′) is made in the lower plate. The distance between (B) and (B′) is the section which must be removed from each side of the body of the mandible. After removal of the section indicated, new models are again mounted and from this new relationship dentures are constructed.

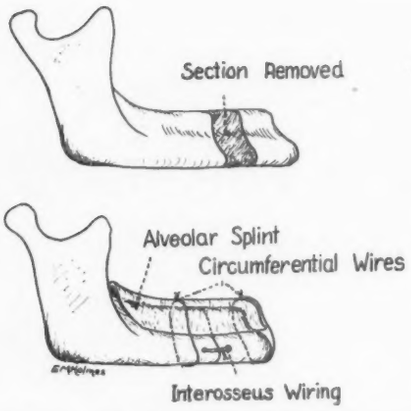

FIG. 2. The perpendicular cut removes a predetermined section of bone. This is the easiest cut to make but it is the most difficult to immobilize, and requires an alveolar splint around which circumferential wires are placed to prevent motion of the fragments. We have discarded the method.

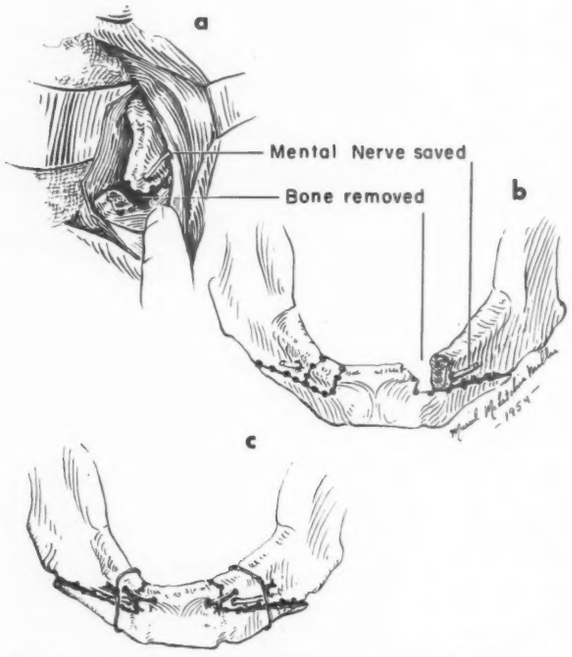

FIG. 3. The "L" incision for shortening and narrowing the mandible. The method of employing a dental drill and fissure burr is illustrated. In (C) note the interdental and circumferential wiring.

PREOPERATIVE PLANNING

In planning an operation for correcting a prognathic jaw, the operator should have: (1) impression study models placed on an articulator in which the upper model may be pushed anteriorly in a horizontal plane; (2) lateral x-rays of the jaws and skull, preferably a sagittal plane cephalogram; and (3) good photographs. A study of plaster models of the dentulous jaws gives a good and positive measure of the amount and place from which to remove a bony section. The models are first made and placed on an articulator which permits the normal hinge action and also allows for an anterior and posterior motion. Occlusal wax plates are next constructed to create a normal contour of the upper and lower lip to ascertain the proper vertical relationship between the face and the jaws. (Fig. 4.)

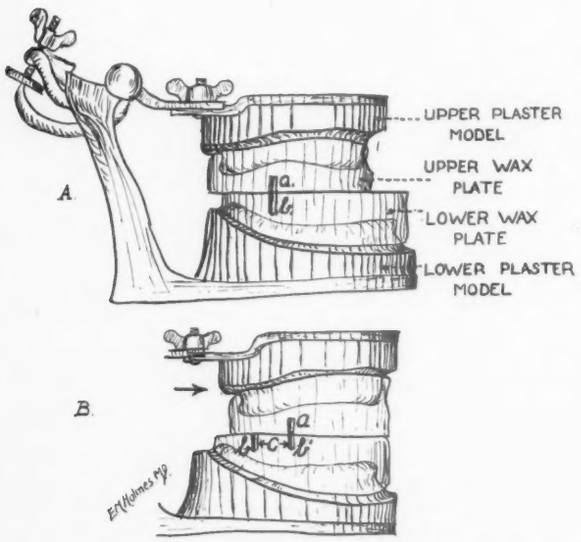

FIG. 4. A, plaster model mounted on an articulator in the same relationship as in the patient. Note marks (a) and (b) on the wax plates. B, the models have been placed into the desired relationship and another mark (b′) made in the lower wax plate beneath (a). The distance between (b) and (b′) indicated by (c) is the amount of shortening desired.

Vertical lines are made on each side of these wax plates while they are in the mouth. Transferring them to the articulator, the upper plate is brought forward until there is a proper amount of front bite, and another vertical line is added below the one already inscribed. The distance between these two lines represents the amount of bone which must be removed to shorten the lower jaw. (Fig. 4.)

X-rays are not essential but assist us in determining the size and shape of the mandible in relation to the maxilla. They tell us the thickness of the body and the extent of the chin flare. With a sagittal plane cephalogram and using the nasion, center of the sella turcica and menton as points through which to draw lines, an angle of plus or minus 75 de-

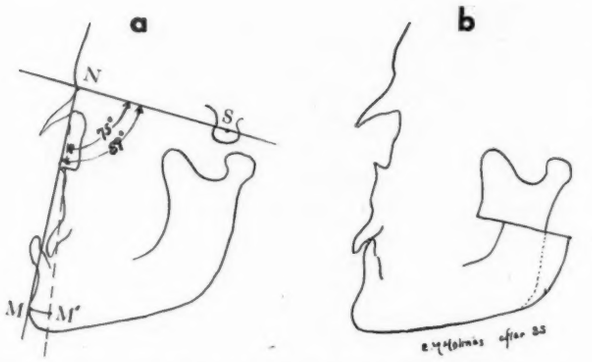

FIG. 5. a, Tracings of sagittal plane cephalogram. Lines SN, NM for an average angle of 75 degrees in the "normal" individual. Angle SNM is 89 degrees. Angle SNM' is 75 degrees. Therefore, the distance from M to M' is the amount of mandible which should be shortened. b, Postoperative reduction.

grees is formed in an average skull. This basic angle may be used as another guide in our planning to correct a prognathic or retruded mandible surgically. (Fig. 5.)

To obtain a more accurate measurement using this method, wax plates including full dentures are fitted to the patient, paying special attention to the fullness of the lip contour and the desirable proportions between the forehead, the nose and the chin before the cephalographic determinations are made. One can then measure with considerable accuracy the amount of bone which must be removed from each side of the lower jaw to give the patient normal chin prominence. An accurate template or caliper measurement is then made for use at the operating table. (Fig. 5.)

Photographs also assist us in evaluating cosmetic improvement.

The following various methods may be used in the correction of prognathism in the dentulous person:

Section of the ascending rami: Section of the ramus is performed obliquely through the bone from below, upward and inward, but parallel to the plane of the superior alveolus. This is performed above the mandibular foramen.

Sectioning of body of the mandible: 1. A predetermined block of bone is removed by cuts perpendicular to the alveolar ridge near the mental foramen. The bones are then approximated and wired interosseously supplemented by circumferential wiring over an alveolar splint. (Fig. 2.)

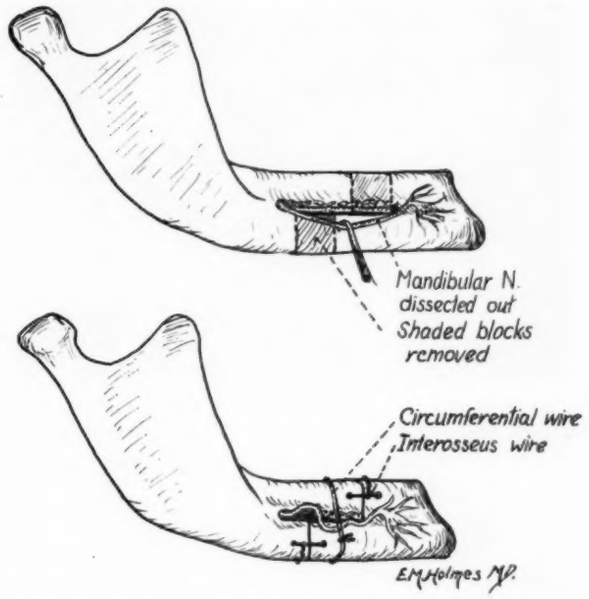

FIG. 6. The "step" cut illustrating the bony cuts which are made through the mandible to shorten it. Top, the mandibular nerve has been dissected free from its canal. Bottom, the interosseous and circumferential wiring completely immobilizes the bones. The mandibular nerve can be placed where no pressure comes to bear on it so that its function is maintained.

2. Utilizing an "L" incision, one cut is made halfway through the body perpendicular to the alveolus, the other branch going diagonally to its inferior surface either anteriorly or posteriorly. A predetermined block is then removed from the anterior cut of the "L" permitting the bone to slide back, thus giving a long contact area for wiring and bony union. (Fig. 3.)

3. A "step" cut is made halfway through the body, perpendicular to the alveolar ridge, and extends along the body before it goes down again to its inferior margin. Predetermined blocks of bone are then removed from each end of the step permitting the jaw to come back into position. This gives a long surface for immobilization and bony union (Fig. 6), and circumferential wiring. An occasional patient may require supplementary fixation utilizing either bit blocks or temporary dentures which permit the use of a sling support under the chin. (Figs. 2, 3 and 6.)

CASE REPORTS

CASE 1. This twenty-three year old man had an extremely small upper alveolus and an unusually

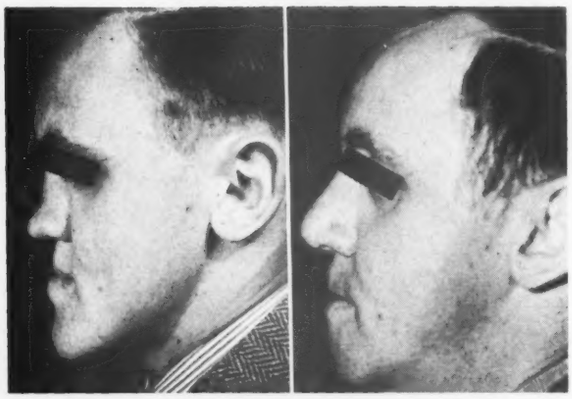

FIG. 7. Case I. A block section was removed. The nose was improved using two technics. Submucous resection of the septum gave cartilage which partially built up the dorsum. The remainder was obtained by using an "ala swing" technic.

large lower one. It was therefore decided to remove a section of bone sufficiently forward to permit not only a shortening but also a narrowing of the mandible (Fig. 1). In this case no attempt was made to save the mandibular nerve as it came directly into the area we wished to remove. Today we would dissect it free from its canal to maintain its function. Impressions and plaster models together with wax occlusion plates were made and placed on an articulator. From studying these models it was decided to remove a slightly wedge-shaped section of the mandible at the mental foramen so that the mandible would become narrower as well as shorter. This is demonstrated in Figure 1.

With the patient under intratracheal anesthesia, the mandible was exposed about the area which was to be removed through a skin incision beneath the jaw. Care was taken not to enter the mouth in order to avoid wound infection from oral secretions. This is not essential today if one operates upon an edentulous patient who is free of sepsis as there is little danger of complications.

The exact amount of bone to be removed was measured off on the bone with a preconstructed template, and a section was cut out employing a motor-driven, reciprocating, straight-bladed saw. Drill holes were made through the main body of the bone adjacent to the cut surfaces and direct wiring was used. To immobilize the surfaces further, a preconstructed alveolar acrylic splint was inserted and circumferential wiring was added to hold the mandible snugly to it. This so completely immobilized the free section of bone that further splinting of the mandible as a whole was not necessary. (Fig. 2.)

The patient was fed through an intranasal tube for a few days until he could swallow without discomfort and with safety. Dentures were next constructed which restored not only a functioning bite but also facial contour.

This patient, as is frequently the case in these prognathic persons, had a nasal deformity which further added to his disfigurement. Rhinoplasty, utilizing an ala swing, submucous resection of the septum and transplant of septal cartilage for dorsal support further helped his appearance. (Fig. 7.)

CASE II. When this twenty-five year old patient presented himself he had many teeth which were so carious and loose from advanced pyorrhea that they were useless to him and had to be removed. He had a large, humped nose associated with a rounding, drooped tip and a badly obstructed septum. Plaster impression models placed on an articulator demonstrated that it would be best to remove a section of the mandibular body instead of cutting the ramus. He also had a very obtuse mandibular angle with an unusually prominent long shelf forming the mental tuberosity and symphysis. It was decided to employ a step incision in the bone so that easier fixation and better bony union would result.

With the patient under intratracheal anesthesia and local infiltration for control of bleeding, a generous incision was made in the buccal sulcus through which the mandible was exposed over the area from which the bone was to be removed. The mental foramen and nerve were exposed. The cortical bone was removed over the mandibular canal permitting the nerve to be lifted from it. This was done by means of a sharp osteotome. Utilizing a reciprocating saw, a step cut was made to section the jaw. A predetermined section was removed from each end of the step, and drill holes were made through the mandible in such a way that stainless steel wires brought through them would cause the bones to be brought snugly together. For further fixation a wire was placed around the mandible over the two arms of the step. (Fig. 6.) The incisions were closed, a small drain was inserted and an external pressure bandage applied. A self-hardening acrylic splint was applied to the alveolus for further bite occlusal immobilization but after twenty-four hours it was found unnecessary and was removed. The patient was permitted to move his jaw without applying any pressure to it. Following the construction of dentures it was apparent that his appearance would be greatly improved if he underwent rhinoplasty to overcome his rather humped, broad, rounding, drooped-tip nose; the badly obstructed, deviated septum was also corrected. (Fig. 8A to C.)

CASE III. A thirty-five year old edentulous woman with a prominent jaw had upper and lower

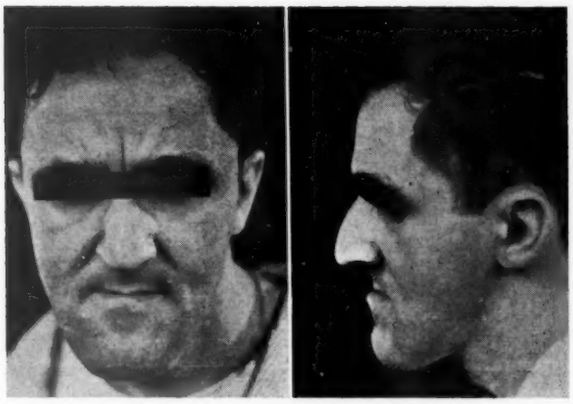

FIG. 8A. Case II. Preoperative appearance.

FIG. 8B. Case II. Postoperative appearance. A "step" incision was used in the mandible. Rhinoplasty was performed to further improve the profile.

dentures which were effective but did not improve her facial appearance. She was considered a good candidate for corrective surgery. (Fig. 9A.) Her upper and lower models with wax occlusion plates were placed on an articulator in their existing relationship to one another. By changing the position of the upper part of the articulator, accurate measurement was made of the amount of shortening necessary.

With the patient under intratracheal anesthesia, an incision was made over the crest of the mandible from the canine tooth to the second molar region. The buccal surface of the mandible including the mental foramen was exposed freely down to its lower border. The mandibular canal was uncovered with a chisel permitting the removal of the mandibular nerve. The bone in this case was cut by using a No. 5 dental burr creating a series of holes along the line of cut throughout the full thickness of the mandible. The cut started along the alveolar crest 1 cm. anterior to the mental nerve extending down to the level of the canal. The cut was then carried posteriorly and inferiorly below the mandibular canal for a distance of about 2 cm. to the lower border of the mandible. The final separation was accomplished with a fissure burr. An accurately measured section of alveolar bone was removed from the posterior stump permitting the anterior section of the mandible to be pushed back into the predetermined position. The same procedure was carried out on the other side. The bones were united by interosseous wires as well as a circumferential wire around the mandible incorporating the cut ends. (Fig. 3.) The incision was closed with interrupted plain catgut. The patient's convalescence was uneventful. Six months following the operation she was wearing dentures with comfort. (Fig. 9B.)

CASE IV. This twenty-six year old woman had a rather marked prognathism of the lower jaw

FIG. 8C. Case II. X-ray shows the good alignment and wiring.

which was edentulous. She was wearing a badly constructed denture and had poor occlusion with her existing upper teeth. (Fig. 10.) It was advisable to reconstruct the mandible so that she could have a properly fitting lower denture which would have proper relationship with her existing teeth and, at the same time, improve her facial contour. As in Case III, the amount of bone to be removed was determined from upper and lower models placed on an articulator, and the same type of operation was performed.

COMMENTS

When we are confronted with a patient who has an edentulous, prognathic jaw we must

FIG. 9A. Case III. This completely edentulous woman underwent an "L" type osteotomy to shorten her mandible. Upper and lower dentures restored the contour of her face and a functioning bite was restored.

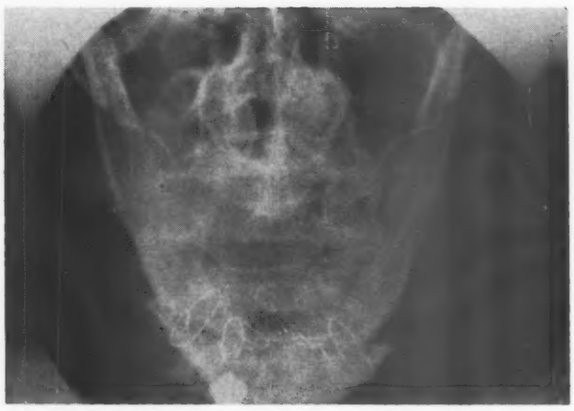

FIG. 9B. Case III. X-ray illustrates overriding of long arm of osteotomy and wiring.

consider the following factors. Will properly constructed dentures give the patient a good functioning bite? Will these dentures also give him sufficient improvement in his appearance so that he is not constantly disturbed by his large jaw? If the dentures will not work or if the jaw is so prominent that the appearance disturbs its owner, we must decide on the best method of reducing its size so that dentures will fit properly, give the patient functioning mastication and, at the same time, improve the appearance so that it is esthetically acceptable. We have come to the conclusion that the best method of correcting an edentulous prognathism is to remove a section from both sides of the mandibular body using either a "step" or "L" incision through the bone in a location which will permit not only a shortening of the mandible but also, in some cases, a narrowing. The right-angle step method is ideal but is most exacting as an equal amount of bone must be taken from both the proximal and distal fragments so that exact approximation will result. When performed correctly this affords the greatest possible surface for union, and immobilization is easy and complete. The "L" incision is the easier of the two as one need remove a section from one end of the bone only. The long arm of the "L" extends beneath the body and merely slides downward where an excess may be removed if indicated. It does have a drawback of lowering either the distal or proximal segments so that the alveolar ridge has a small step, unless the long cut through the bone is fairly wide, but this is not of practical importance because the dentures can be made to cover up this irregularity.

To assist us in the selection of the site and the amount of bone to be removed, plaster models of the upper and lower jaws mounted on an articulator, which will permit an anterior and posterior motion, together with wax bite blocks are our basis for study. We also like to have a good profile photograph of the head and a sagittal plane cephalogram which further assists us in measuring the amount to be removed. The operation is performed intraorally. The mandibular nerve is freed from the canal and saved. Predetermined sections of bone are then removed from both sides of the mandible and bony fixation obtained by direct interosseous as well as circumferential wiring. The case in which a through and through section of bone was

FIG. 10. Case IV. This patient had upper teeth. An "L" type bony cut was employed to section and reduce the size of the mandible.

removed and the nerve disregarded was successful but the method has been discarded by us. Two of these patients had associated with the prognathism a disfiguring nasal deformity which was corrected to improve the over-all esthetic picture.

SUMMARY

Some of the problems encountered in edentulous prognathism are discussed, together with practical methods of reducing the size of the mandible which will permit the construction of functioning dentures as well as improve the esthetic contour of the face. Four cases are presented to illustrate a method of preoperative planning and the various operative procedures and ways of fixation which may be employed.

Acknowledgment: Dr. Holmes is grateful to Harry Gullifer, D.M.D., for his collaboration in Case I and to August Stemmer, M.D., D.M.D., Resident at the Massachusetts Eye and Ear Infirmary, who made the study models and assisted in Case II.

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Foreign Bodies in Maxillofacial Surgery

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THE specialist most often concerned with foreign bodies is the maxillofacial surgeon, for the head is the most exposed part of the body and gives passage to two main systems (respiratory and digestive), both of which are easy prey for foreign bodies. The purpose of this presentation is not to demonstrate any particular method or technic for removal of foreign bodies but to consider the problems associated with it.

The importance of exact localization of the foreign body is to be emphasized. Such accuracy is vital when deciding upon a method or technic for removal. One must be aware of the location of the foreign body in bone, in soft tissue, in a cavity, or in a combination of many places. There are many cases of extensive damage to vital structures, not because of the foreign body itself but because of the search for it. At the very least, anteroposterior and lateral view x-ray films are necessary, and in certain cases laminagrams and special x-ray studies should be requested.

Foreign bodies in the ears and nasal cavity are usually found in the child of preschool age and vary greatly. In such instances the objects may be present for some time before they are noticed by the parents because of infection, pain or damage to local or neighboring structures.

In the eyes and orbital regions, foreign bodies are best treated with the cooperation of an ophthalmologist because of the possibility of serious operative and postoperative complications.

Foreign bodies in the paranasal cavities, especially those in the maxillary sinus, are frequent and often arise from dental misadventure. Such foreign bodies include fragments of teeth or tips of sharp instruments. Metallic fragments due to gunshot wounds of the face are not unusual.

Foreign bodies in the soft and hard tissues of the mandibular area should be considered with special care. These are often produced by gunshot injuries; if metallic fragments are lodged between bone fragments or imbedded in muscle, severe pain and dysfunction can develop.

The pharyngeal area is frequently involved by such foreign bodies as fishbones. The lodging of a fishbone in the throat is so common as to be a subject for mirth, yet this foreign body may be deadly because of mediastinal involvement and therefore cannot be treated lightly. Sometimes foreign bodies in the pharyngeal area cause less trouble when left in place than when removed. These foreign bodies may be tolerated for long periods without symptoms. Periodically, however, oxidative changes may excite serious complications, especially in the neighborhood of major vessels. Here it may be wise to remove the foreign body before it is too late.

In the hypopharyngeal area, because of the anatomical features, foreign bodies related to the pyriform sinus, epiglottis, upper larynx and cricopharyngeal sphincters present their own special problems. The variety of foreign material is boundless. Pins, bones, coins and dental prostheses can lodge there. Again, special study of the x-ray films, of the type of object, and study by indirect or direct laryngoscopy are essential.

Although this paper is primarily concerned with extrinsic foreign bodies, it is desirable to mention those non-functioning tissue remnants or products that may behave like foreign bodies, such as salivary calculi, non-vital tooth remnants or isolated small bony fragments.

To summarize, it is clearly apparent that the problem of foreign bodies is a complex one, especially when medicolegal aspects are involved.

Often the tissue will tolerate these foreign bodies for indefinite periods of time, but they must be removed when there is pain, dysfunction or infection.

Adequate presurgical preparation and study of the foreign body and its location are necessary for satisfactory results.

Medical-Legal Liaison—An Urgent Necessity

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MAXILLOFACIAL surgeons are aware of the increasing relationship between the practice of medicine and law. There is no necessity for reminders that in this field we are confronted with this relationship as often as are men in any other medical specialty.

For the most part the physician is not equipped by his educational background to face adequately the problems, medical and legal, that comprise the field of forensic medicine.

A DEFINITION OF FORENSIC MEDICINE

Both interested laymen and numerous physicians and attorneys have frequently sought a precise definition of the term forensic medicine. Forensic is a term derived from the Latin word *forum*. It is an adjective meaning belonging to the courts of justice or to public debate, and is used in either legal proceedings or public discussion. Forensic medicine is also referred to as legal medicine or medical jurisprudence. Of all the formal definitions, my own preference is taken from Black's Legal Dictionary: " . . . that science which teaches the application of medical knowledge to the purposes of law; hence its limits are on the one hand, the requirements of the law, and on the other the whole range of medicine. Anatomy, physiology, medicine, surgery, chemistry, physics, and botany lend their aid as necessity arises; in some cases these branches of science are required to enable a court of law to arrive at a proper conclusion on a contested question affecting life or property."

THE PROBLEM

Practically, the problem is simply in achieving an understanding between the physician and the attorney. This is a prerequisite to afford proper guidance from the bench in conducting a legal proceeding. It is the paramount objective to be reached prior to a verdict from a lay jury. Let us never forget that the singular purpose of all litigation is equal justice for both the plaintiff and the defendant. This is a simple end, but the means employed in reaching it are increasing in complexity in almost, I might say, geometric progression with our hourly advances in the physical and social sciences.

The special problem of the person who labors in medical jurisprudence is the understanding of the relation and application of medical facts to legal principles.

A question that is put to me, usually at this time, by the layman is, "Well, doctor, what is the problem? I don't see anything complicated about a lawsuit begun by an individual who has suffered a physical injury." To the ordinary citizen who has never participated in litigation there is no problem. However, when one talks to a trial lawyer who works constantly with such cases, there is no doubt regarding the existence of a problem. I might add there is also no doubt in the mind of the physician who has had experience on the stand as an expert witness in a lawsuit. Moreover, when one talks with a former plaintiff or defendant in such litigation, one obtains some clear-cut opinions from this experienced layman.

The formula for the disposition of these cases is simple. Ideally, a plaintiff receiving an alleged injury employs counsel. His attorney then approaches the defendant's lawyer and presents the complaint, with or without medical documentation. Depending on the circumstances, a settlement out of court may be attempted. This is preferable to the expenditure of money and time in litigation. If no settlement is forthcoming, the case then goes to court. Here each side presents its evidence, which usually includes the testimony of expert medical witnesses. The jury hears the testimony, weighs the evidence and, under proper instruction from the bench, arrives at a verdict.

The formula may be simple but it does embody possibilities for untoward complications.

The elements that are required for this amalgamation of law and medicine are known to be two of the most individualistic professional philosophies in our society. Historically, neither the medical nor the legal profession has established itself as a group without strong dictates of principle. Perhaps no two groups are more noted for their individualistic personalities. Members of these groups are highly critical of themselves and their fellows. The philosophy of freedom of thought and expression which the lawyer and the doctor apply regularly in part explains the degree of excellence achieved in both professions over the past two centuries. It is not inaccurate to state categorically that these are two of the most influential groups in our society today.

While self-criticism and individualism are prevalent in both groups, there is also a marked tendency for each to knit together and protect itself from outside attack. This is not an unhealthy tendency because it promotes the principle of internal policing of errant members. Of course, any of these concepts may be overworked. Either the individualism of the practitioner or the cohesiveness of the profession may be projected unrealistically. This fact in itself poses intricate problems which have filled countless volumes.

Litigation involving personal injury has increased with inordinate rapidity since 1900. As our technological advances and population have risen at a meteor-like pace, the dockets of our courts have reflected an astronomical rise in lawsuits of this type. A case in point was the $275,000 out-of-court settlement made on April 8, 1958, by Socony Mobile Co. This litigation involved a paralyzed service station manager and is believed to be the largest of its type on record. The largest judgment by a court was recorded recently in Chicago; this negligence award was for approximately $700,000. These large figures are somewhat deceiving. I recently obtained the average annual figures for an area known for verdicts involving large settlements. The average judgment for the plaintiff was $6,000.

Communication. Many times it is difficult for us as practicing physicians to understand our colleagues who are working in fields that pertain to our specialties. In the same vein, it is difficult for the attorney to follow the mental gymnastics employed by some of his legal confreres. The complexity of the vocabularies has increased with the general complexity of the subject matter.

The languages of medicine and law are difficult. For example, the common medical term of "trauma" may throw an attorney into confusion, while the use of the term "estoppel" by a lawyer may strike a physician dumb. We are confronted with the problem of communication of precise thoughts in our specialized society. This represents a sizable obstacle in the conduct of legal proceedings. It is not insurmountable, and it can be overcome in a generally acceptable manner to the mutual satisfaction of both professions. This problem is being reduced constantly by interested educators. I consider it to be a technical question that is not overly complex once recognized.

RECENT COMMENTS OF PHYSICIANS AND LAWYERS

In the *New York Times* of March 10, 1958, a prominent neurosurgeon, who is also president of a large international surgical society, described the problem as he viewed it. He spoke with the conviction of a man who has had "twenty years of personal experience." He stated that the business of lawyers is cunning. The opposing lawyer is in court for the sole purpose of making money; the attorney is bluffing from start to finish. "He is the Brooklyn cowboy with the blank cartridges." He described " . . . attorneys' brutal efforts to undermine testimony of expert witnesses. If the truth were all that was sought, there would be no need for lawyers at all."

Our colleague certainly exposed the problem with a sharp, direct incision. His diagnosis was clear and his suggested therapy was radical.

"It is high time that we put a stop to this disgraceful imposition upon us by a group of men who use us and abuse us for their own personal gain." He suggests that when lawyers go into action doctors should "Employ trick for trick, cunning for cunning. Let the legal profession beware. The doctor is throwing his hat into the ring."

Thus the situation was laid bare. The problem was presented squarely not only to the two professions but also to the world at large. One may not agree with the nature

of the problem or the therapy recommended, but we must agree that this physician did not fail to deliver for all to see a clear view of this heretofore smouldering problem that has stricken the vital parts of the medical-legal relationship.

As was to be expected, there was immediate rebuttal from the legal profession. A spokesman for one of the most powerful legal fraternities described the speech as "unparalleled in its irresponsibility." However, the outstanding rebuttal to date was delivered in the amphitheatre of the Harvard Medical School on March 21st.

Justice Felix Frankfurter, who, in his capacity as member of the Supreme Court of the United States, is unquestionably qualified to answer for the legal profession, noted the growing awareness of an interdependence of different professions. He suggested that in law there is a tendency for the attorneys "to stick too close to their immediate concern and to move too confinedly in their narrow specialized groove." I might add that he generously allowed the physicians to decide for themselves how this state of affairs applied to practitioners of medicine. Justice Frankfurter further stated, "It is certainly true of the law that its profession is pursued too individualistically—there is a failure to keep in mind through self-education and alertness what Senator Elihu Root called 'the public profession of the law.'"

Let us at least face the obvious fact that this distasteful medical-legal problem exists, that it can only be compounded by recrimination and reprisal on the part of either profession. The interdependence of which Justice Frankfurter spoke is growing steadily day by day. There is no evidence of its becoming anything but stronger.

The time has come for the two professions to reach a common understanding and a plane of mutual respect and cooperation. The individual citizen who seeks justice in our courts stands to lose more than either the opposing physician or attorney. We must therefore, by the ethics of our two professions, come to terms in the interest of the patient and client.

RECOGNITION OF THE PROBLEM

We must discover here, just as in any disease, the specified etiology. What factor most directly contributes to the sickness of the medical-legal relationship? To begin with, we must develop a feasible theory. Having received education in both fields, my personal theory is a simple one. I do not believe that this condition is confined to medicine or law, but rather I am convinced that it represents one of the great faults of American education.

Recently American education has been criticized in many ways. The most common accusation after Russia's scientific first was that we fail to afford our students proper scientific instruction. The emphasis of this school of thought falls on the technical and physical sciences. Other educators are avid proponents of the humanities and social sciences. One may choose sides and select his corner for this battle on the curriculum of the secondary and undergraduate schools. I will not attempt to discuss these educational levels.

My indictment is directed squarely to the medical and legal system of graduate education in the United States.

My concern is the graduate school. Here is an area of unrivaled importance in our system, for the graduates of these schools are potentially the future leaders of our nation. These graduate students are drilled for years in the technic and philosophy of their professions. Physicians, for instance, are taught the technic of the laboratory and bedside. They emerge as men who are required to combine applied sciences with the art of healing. It takes fourteen to seventeen years to train a competent medical specialist.

The lawyer is drilled in his profession for a total of seven years of academic training. He also requires another three to five years of clerkship before he is a legal specialist. This may be compared to the internship or residency of a physician.

However, despite this impressive expanse of time, representing thousands of dollars of investment and hours of grueling study and effort, along with the irreplaceable years of youth spent in the classroom, hospital and office, we are failing as educators to equip our professional man properly.

Our failure is on two basic counts. First, we attempt to gorge the students on the practical "aspects of his profession." In medicine we spend hours on theories in basic science or studies of rare diseases. How many medical

schools teach the student of his rights or duties in a court of law? When is he taught how to give acceptable testimony which may be the deciding link in a chain of evidence that takes another's life in a criminal case, or his freedom or property in a civil case?

How many law schools teach the student how to cross-examine a physician, to understand when a yes or no answer is possible? When is he instructed in the proper technic to obtain a medical fact?

Second, we fail abysmally in the communication of our basic professional philosophies. The physician often feels bullied in court. He believes that no one wants to hear what he came to say. He believes that he has received unfair treatment at the hands of the legal profession. How can he be expected to know that our Anglo-Saxon concept of law is based on the adversary system? In this system one gives legal warning to the opposite party. An opportunity is then offered to the accused to contest the charge and defend himself in court. This right is guaranteed by our Constitution. To protect this right we must have two attorneys who oppose each other unequivocally. The attorney must use his knowledge and skill to elicit testimony from witnesses best calculated to obtain a verdict for his client. If he fails to use his talent to the fullest, he is failing in his professional duty. His paramount objective is to win lawsuits just as it is the paramount objective of the physician to correct disease. Was the medical student told that this is the best system of law known to have existed over the past 2,000 years? Does he know that the good trial lawyer lives to try cases in court just as the well trained surgeon prefers the operating room to all other environments? He does not because, for the most part, he knows nothing about legal philosophy.

On the other hand, how many attorneys have wrung their hands over medical experts? They wish certain questions to be answered in a specific way. Anyone familiar with the philosophy of medical science and practice knows that attorneys cannot always be given the answers they desire, if the physician remains honest. As law students when were they exposed to the basic tenets of medical philosophy? The answer is, usually never.

It is not, therefore, impossible to suggest that we must indict the entire system of graduate education in law and medicine. Especially in this age of specialization and of increasing interdependence, we must re-evaluate our sense of the so-called practical subjects.

In the same vein, we must also be certain that the political scientist who considers the peaceful pursuit of nations must know not only the simple propensities of nuclear fission but also the basic philosophy of the physicist who creates the bomb.

Some steps have been made in this direction by a few universities; these have been usually highly inadequate.

I would like to propose the following recommendations:

1. On the educational level, a committee of medical jurisprudence should be established in every university in this country. This should be staffed by a combined faculty that represents the best available men in their field. It should be a required course for graduation and by no means relegated to some obscure place on the schedule of "elective" courses or taught by some disinterested faculty member.

2. The practicing physician and attorney should be represented by members of their local medical societies and bar associations on a combined committee. These committees should be chosen in every major community in the United States. They should have regular meetings and publish reports periodically to members of both societies. Furthermore, each bar association and medical society should enter into joint meetings with the full memberships of both societies each year so that problems and questions might be presented from the floor in the presence of both memberships.

3. I suggest that an institute be established in Washington, D. C., dedicated to the forensic sciences. Washington, D. C. is not only the Nation's capital but also the center of the Western sphere of influence. It lies in the heart of the group of foremost universities on the East coast. Talent from the legal and medical faculties from the entire Atlantic coast have easy access to the city. Transportation from the Central and Western states is readily available. It is here that the Supreme Court sits, that Congress passes on medical legislation, and the Bureau of Health, Education and Welfare resides. The large government-sponsored research centers are available: The

National Institutes of Health, the military medical centers, The National Medical Library, The Armed Forces Institute of Pathology.

The specific contributions of such an institute would be: (a) to serve as a clearing house for information which would be available to members of both professions; (b) to achieve greater understanding by forums, addresses and presentation of papers by leading members of both professions; (c) to stimulate organized research into specific problems concerning either profession; (d) to offer a sounding board for the ideas of the interested leaders in law and medicine.

Parts of the aforementioned proposals are being employed in a few universities and communities at present. It is obvious, however, that with the present state of affairs, as regards the law versus medicine, these concepts are not universally accepted.

I have discussed these recommendations in some detail with nationally known practitioners both in law and medicine. They mutually agreed that these steps should have been taken long ago. None of these men, however, were of the impression that these proposals could be instituted without the expenditure of considerable thought, work and patient understanding.

Let us project this problem to the larger screen of world affairs. How can we expect different nations with a language barrier, different concepts of justice and humane treatment of citizens to coexist happily, when our nation's two leading professions, whose members speak the same language, are educated in the same universities and, in theory, are interested in the same objectives, are busy declaring total war one upon the other?

A large portion of the accepted social philosophy of our time has been adapted from the pre-Christian era of early Greece. Aristotle, who revered the physician as well as the legal philosopher, had this to say:

"*For there really is, as everyone to some extent divines, a natural justice and injustice that is binding on all men, even on those who have no association or covenant with each other.*"

Antihemorrhagic Agents in Plastic and Maxillofacial Surgery

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THROUGH the countless hundreds of years that surgery has been carried on in many forms, bleeding has always been a very difficult problem in the care of patients. One of the earliest methods used to lessen bleeding during surgical procedures was the use of the cautery. Usually a hot iron was used and this was very effective as well as destructive. Later, however, other methods began to be adapted such as the use of hot and cold applications to the bleeding areas, the clamping and ligation of vessels, and more recently the use of drugs to prevent bleeding.

As early as the latter part of the last century, Osler found that certain foods could effect bleeding states. In a condition now known as Rendu-Osler-Weber disease, it was found that bleeding responded to the use of citroid foods. This condition gives a familial history of recurrent epistaxis and multiple telangiectasia, and Osler recommended eating the rinds of citrus fruits.

In discussing bleeding at the surgical table we must differentiate between capillary oozing and arterial and venous bleeding. There is no substitute for the clamp and ligature for arterial and venous bleeding. This paper is primarily concerned with the problem of capillary oozing which can be a very difficult one in certain types of surgery, particularly in the field of plastic and maxillofacial surgery.

At the present time and for many years many drugs have been used topically. These have included Adrenalin,® hot and cold packs, thrombin and Gelfoam,® among others.

For some time now it has been known that drugs taken by mouth would lessen capillary oozing presumably by strengthening the capillary walls. Vitamin C and vitamin K have long been known to have an effect in certain bleeding states. Certain estrogenic compounds have been successfully used for functional uterine bleeding, and drugs which contain oxydative adrenalin products have been recommended to decrease capillary oozing. Water-soluble bioflavonoid compounds with vitamin C for oral intake have been recommended for the same purpose. Products which contain bioflavonoids in the form of esculin, hesperidin methyl chalcone, vitamins C and K and rutin have all been believed to be effective separately in capillary oozing. It is also believed that when some of these drugs were placed together they were synergistic and thus more effective. One of the commercial products on the market at this time contains these bioflavonoids in the form of esculin, hesperidin methyl chalcone and vitamin C and vitamin K used jointly.* This drug has given exceptionally good results in our hands and in the hands of many other surgeons. Of all the drugs mentioned previously, only the last-named drug can be used intramuscularly, orally and intravenously with safety and excellent results.

In a series of 250 cases this drug has been particularly effective when used properly. In this series of cases the drug was used intramuscularly the night before surgery and in the morning prior to surgery. In certain types of cases it was given intravenously during the procedure. When given orally, the drug must be used for five to six days preoperatively before it becomes effective at the surgical table.

This drug was particularly effective in rhinoplasties, pharyngeal flaps, and in the treatment of hypospadias, chordee, cleft palate and large granulating surfaces, and particularly burns which were to be grafted. In rhinoplasties it was found that the amount of

* Hemocoavit, supplied through the courtesy of Wynlit Pharmaceuticals, Inc., Madison, New Jersey.

adrenalin used to produce constriction could be cut down by 75 per cent. It was also found to be effective in the treatment of postsurgical bleeding, in postrhinoplastic nosebleeds without any packing, and after operations for cancer and reconstructive surgery of the face when oozing has been a particular problem. The drug is used as follows: one ampule is given at bedtime and one ampule two hours before surgery; a third ampule is given one hour before surgery. All are given intramuscularly. This has been effective in long, drawn-out procedures, particularly grafting for burns where oozing on granulating surfaces and postoperative hematoma are problems. It has been used intravenously throughout long procedures by putting one ampule into the intravenous tube and two or three ampules into the intravenous bottle.

At a recent panel discussion at the Hartford Hospital in Hartford, Connecticut,* the topic of discussion was the problem of capillary oozing in surgery. The panel discussed most of the agents available today for oral or parenteral use to lessen oozing. It was the unqualified opinion of this group that the combination of esculin and hesperidin methyl chalcone along with vitamin C and vitamin K used as prescribed was most efficacious.

As a result of these findings and those of many other groups, it would seem applicable to use these products more routinely and prophylactically in surgery when oozing is a potential problem.

* Discussion led by Dr. Perry Hudson, Director of Urology, Francis Delafield Hospital, New York, New York.

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Necrotizing States of the Maxilla

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NECROTIZING diseases involving the maxilla are frequently an enigma in medical practice. Their occurrence is not rare. Etiology and diagnosis are often obscure. For this reason diagnostic procedures must be extensive.

Many disorders involving the maxilla are self limiting, such as those of allergic and bacterial origin in which only the mucous membrane is involved. Others, including malignancy and radiation effect, may destroy soft tissue and bone. It is the purpose of this article to consider, however, certain necrotizing states which are perplexing problems in diagnosis and treatment. Some emphasis is placed on a fatal group of undetermined origin. Necrosis of the maxilla may first be recognized as a lesion in the mouth, near the canthus of the eye or in the nose. These are here briefly classified:

I. Bacterial:
   A. Non-specific (aerobic and anaerobic)
   B. Specific (tuberculosis, syphilis, sporotrichosis, klebsiella, Hansen's disease, yaws)
II. Fungi: Actinomycosis, aspergillosis, coccidioidomycosis, blastomycosis, moniliasis, histoplasmosis, rhinosporidiosis, sporotrichosis, glanders
III. Allergic: Periarteritis nodosa
IV. Protozoan: Leishmaniasis
V. Undetermined:
   A. Granuloma
      1. Granuloma gangraenescens (Synonyms: malignant granuloma, progressive lethal granuloma, granulomatous ulcer of unknown etiology, chronic infectious granuloma, osteomyelitis necroticans faciei, idiopathic lethal granulomatous ulceration of midline facial tissues, lethal granuloma of nose and face)
      2. Wegener's granulomatosis
   B. Associated with neoplasm
      1. Reticulum cell sarcoma, Hodgkin's disease

CASE REPORTS

The cases and discussion follow the classification given heretofore. Seven representative histories are presented. In several the symptomatology is similar but the etiology differs.

Bacterial—Aerobic

Metastatic Bacterial Osteomyelitis. (Case 1.) A thirty-seven year old veteran was hospitalized in 1955 because of recurrent pain and swelling in the distal portion of the left femur. A compound fracture of this bone had been sustained while he was in service ten years earlier.

A diagnosis of chronic osteomyelitis of the limb had been made. Shortly after the recent hospitalization a fluctuant thigh abscess was opened and drained. Strains of staphylococcus were isolated. (Table 1.)

On the eighth hospital day, just before the leg drained, the patient noted a roughened, tender ulcer in the hard palate. (Fig. 1.) A septic course followed. Multiple abscesses of the alveolar process of the maxilla developed. He had never had dental caries or peridontal disease. Fulminant necrosis of the maxilla and nasal chambers occurred. The teeth loosened and were extracted to relieve the pus.

Transient diabetes mellitus was discovered. The patient had not been known to have diabetes previously. Extensive evaluation failed to reveal a diabetic state after the active infection.

Six months following onset of oral symptoms, total sequestrectomy of the palatal process was performed. Parts of the maxillary sinuses and also the floor of the nose were thereby removed. The leg symptoms subsided.

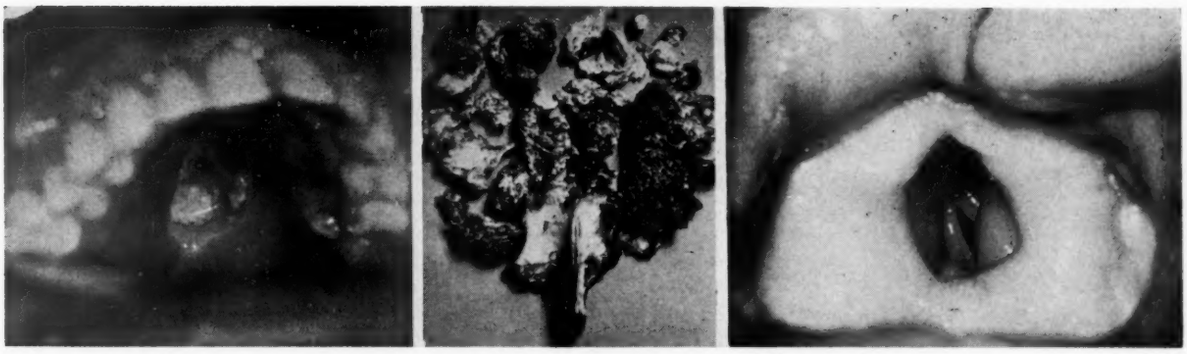

FIG. 1. Case 1. Shows acute metastatic osteomyelitis of maxilla with destruction of palatal process. To *left* is seen large palatal ulcer. All the maxillary teeth were extracted, without avail, in an effort to establish drainage. *Middle* view shows sequestrum of entire palatal process, removed months later. On *right* is seen healed mucosal flap from palate preserved for reconstruction at time of sequestrectomy. In defect area are seen parts of the turbinates and remnants of the perpendicular ethmoid plate. A full denture prosthesis was placed later.

Large quantities of antibiotics were used throughout the course. Healing was uneventful. Temporary and permanent dental prostheses were constructed. When last seen three years later the patient was without recurrence of disease in the facial area or in the left thigh.

Acute Osteomyelitis in an Infant. (Case II.) A child with a normal birth history was found to moan when placed on the left side of her face at two weeks of age. At one month there was proptosis of the left eye and an ulcer appeared near the inner canthus. At three months swelling and pus occurred near the left nasal and orbital areas. (Fig. 2.) A leukocyte count of 40,000 per cu. mm. was reported. An abscess beneath the left eye was incised. A probe could be passed into the maxillary sinus and into the buccal sulcus of the maxilla. Seventy cubic centimeters of pus, cultured as Staphylococcus aureus, coagulase positive, was obtained. The organism was sensitive to Chloromycetin® and erythrocin.

When the child was four and a half months of age, sequestrectomy was performed to remove bone near the inner canthus of the eye. Healing has been uneventful to date, except for transient neutropenia attributed to antibiotic medication.

TABLE 1
BACTERIOLOGIC CULTURES (CASE 1)*

Organism	Location			
	Leg	Mouth	Nose	Blood
Staph. aureus (coagulase positive)	+ +	+ +	+ +	− −
Staph. albus (coagulase negative)	+ +	− −	− −	− −
Str. faecalis	−	+ +	−	+
Esch. freundii	−	+ +	±	−
Klebsiella	−	−	+	−
Paracolon	−	−	+	−

* Staph. aureus, coagulase positive, was isolated from a leg wound, from the oral cavity and from the nose. Str. faecalis was found in the oral wound and in the blood.

Comment on Bacterial Necrosis. These two cases are illustrative of the extensive involvement which may occur. The metastatic osteomyelitis to the maxilla is a rare condition. Osteomyelitis of the maxilla in infants is now uncommon. Prudent medical and surgical management are necessary.

The Staph. aureus organism accounts for most infections in osteomyelitis. Geschickter and Copeland [1] estimate that between 75 and 90 per cent of embolic osteomyelitis is caused by this organism. Hemolytic streptococcus is next in frequency, more often found in children under the age of two. Immunity to staphylococcus and streptococcus is not developed in the human body, and these organisms remain a potential source of infection.

McCarroll and Key [2,3] reviewed 200 consecutive cases of osteomyelitis in children. "In fifty patients who developed secondary foci, there were eighty-one metastatic lesions, an average of 1.62 per patient. Thus a patient who

FIG. 2. Case 11. A large infraocular abscess, from which 70 cc. of pus were drained, developed in this three month old infant (*left*). The left maxillary sinus area was completely destroyed and a probe could be passed from the abscess into the oral cavity. Several months later a sequestrum was removed from the lacrimal duct region (*right*).

develops one secondary focus is liable to develop others." In a series of cases studied by Wilensky [*4*], 6 per cent were metastatic osteomyelitis.

The mechanism of extensive osteomyelitis is discussed by Macbeth [*5*]. He quotes Wilensky in describing the arterial supply of the maxilla and points out that almost the entire blood supply is from a single trunk, the internal maxillary artery. This breaks up into numerous small arteries, forming loops, which anastomose freely. Sequestration conforms generally to the arterial arcade system. He explains that there is no subperiosteal network of vessels in the maxilla and therefore bony regeneration is almost entirely absent and healing is by fibrous tissue. "This lack of vessels beneath the periosteum also probably explains why spontaneous spread of infection from a sinus so rarely occurs, as compared to what happens in the frontal region."

Lillie [*6*] has pointed out that in the maxillary bone there is free anastomosis of the terminal branches of the internal maxillary artery, insuring integrity of bone except where the main artery is involved. It has also been observed that in osteomyelitis of the maxilla the infection frequently localizes in the region of the lacrimal sac and that infection spreads by a plexus of veins to the endocranium [*7*]. Lederer [*8*] has pointed out that the thromboembolic and thrombophlebitic phenomena prevent complete repair.

Osteomyelitis of the maxilla in infants has decreased since the use of penicillin. McCash and Rowe [*9*], reporting in 1953, state that less than 100 cases have been reported in the English and American literature since the condition was first described in 1847. They note that only thirteen cases have been reported since the introduction of penicillin. The authors point out that the infection may begin in the oral cavity mucosa adjacent to the unerupted first permanent molar. Since there is no sizable maxillary sinus in the infant, the disease process spreads rapidly from the infected oral cavity to the orbit and lacrimal regions. Dacryocystitis and orbital cellulitis may be difficult to differentiate from osteomyelitis in the infant. Haworth [*10*] described five cases of osteomyelitis in infants in 1947. In one infant, aged seven weeks, a septic finger was noted in the first week of life, and a swelling below the left eye developed ten days before admission.

Transient diabetes mellitus as related to severe infection is discussed by Hinkle and Wolf [*11*]. Duncan [*12*] states, "There are a few patients who have presented no detectable evidence of diabetes under normal circumstances, but who have manifest diabetes during the course of acute infection, notably infections due to staphylococcus aureus and especially with carbuncles."

Goodman [*13*] states that Williams and Dick found " . . . glycosuria in forty-one per cent

FIG. 3. Case III. Views, from left to right, show progressive fatal course of facial involvement in necrosis of maxilla. Patient was studied over eight-year period. Photograph to *left* shows indurated area which would develop and recede beneath the eye early in course. Photograph on *right* depicts how facial appearance was markedly altered by spreading necrosis of bones beneath.

of non-diabetic patients with acute infectious diseases, the largest amounts occurring with influenza." Duncan suggested that lowered carbohydrate tolerance in the diabetic or non-diabetic patient might be due to: (1) decreased production of endogenous insulin, (2) increased production of hormonal antagonists, (3) insulin destruction, and (4) disturbance of the utilization or storage of insulin. Of these, Goodman believes that ". . . the excess production of the adrenal ketosteroid is the most likely mechanism during acute infection.

Bacterial—Specific

Necrosis, (?) Syphilitic. (Case III.) A twenty-seven year old white woman had been treated twenty years earlier for abdominal discomfort. While hospitalized a general rash occurred on the body, and a 4 plus Kahn reaction was found. She was treated with arsenicals. There was a history of a stillbirth at the sixth month of pregnancy.

Not until thirteen years later did nasal symptoms develop due to polyps. These polyps were removed. A second polypectomy some time later was followed by high fever. Solid edema of the face and a crusting of the nose developed.

The patient was studied over an eight-year period, until her death in 1958. A small red area beneath the eye would develop occasionally, accompanied by fever. (Fig. 3.) The course was chronic, and with antibiotics improvement occurred. The nasal septum, maxillary sinuses, turbinates, ethmoids and sphenoid sinuses became involved by a foul-smelling, granulomatous lesion. Palatal ulceration and dehiscence occurred.

In 1951 spinal fluid examination showed a flat colloidal gold curve. Six million units of penicillin were given in the belief that the diagnosis was latent syphilis. Electrophoretic studies showed increased gamma globulin. The Congo red test indicated no amyloid. Numerous serologic tests were negative. A coagulase-positive Staph. aureus was found. Six biopsies failed to show tumor. Allergy tests showed sensitivity to molds, and treatment was given. Fungus was never cultured. X-ray examination of the chest was negative for abnormalities. All efforts at antibiotic therapy failed.

Necropsy showed pansinusitis and osteomyelitis involving the maxilla, ethmoid, sphenoid, orbital fossae and palate. Abscess of the frontal lobe with focal meningitis was found. In the kidney a hemorrhagic and necrotizing papillitis was found. The microscopic findings showed polymorphic infiltration in areas of necrosis of the facial tissues.

Necrosis, (?) Syphilitic. (Case IV.) A forty-one year old white man was aware of nasal discharge at about seven years of age, shortly after having whooping cough. He recalled that bits of bone came from the nose in the following years, and that a palatal ulcer occurred soon after the whooping cough. There was narrowing of the nasopharyngeal inlet by a scarred soft palate. (Fig. 4.)

Attempt at surgical repair of a saddle type nasal deformity and of the palatal defect failed. On a routine follow-up there was swelling of the legs and an elevated temperature. A 2 plus urine albumin was found, and the patient was evaluated as having renal disease. Biopsy of the kidney showed acute glomerulonephritis.

The sputum test for tuberculosis was negative. Skin tests for histoplasmosis and coccidioidomycosis were negative. A pleural reaction in the right

FIG. 4. Case IV. Palatal ulcer, with destruction of the nasal bones, developed in patient who had had whooping cough when seven years of age. A positive T. pallidum immobilization test was made. *Top* photograph shows saddle nose deformity, and *below* is seen palatal defect. Both areas failed in surgical repair.

lung base was described. Electrophoretic studies showed a diffuse increase in gamma globulin. Antistreptolysin-O titer was 333. Spinal fluid was normal. Treponema pallidum complement fixation was non-reactive, but T. pallidum immobilization test was reported as "weakly positive." X-rays showed involvement of the vomer and ethmoid cells.

The necrosis of the maxilla has been chronically progressive, but the generalized kidney infection has subsided.

Comment on Syphilitic Necrosis. Syphilis is capable of producing necrosis of the maxilla. The gumma of the hard palate, the scarring of the fauces and the saddle nose deformity have often been described. These sequelae were more common before the use of antibiotics. The primary lesion has been found in the nasal septum, and the lesions occurring from congenital syphilis are well known. "Syphilis may and does cause suppuration in any one or even all of the sinuses on one or both sides of the nose" [*14*]. In long-standing cases the secondary invaders increase the destruction.

The two cases just described have been classified as being of syphilitic origin. The presumptive evidence in each case suggests syphilis. A critical evaluation of the case histories, however, reveals significant gaps in the knowledge of this disease as related to necrosis of the facial bones.

In the instance of the woman described, a fairly accurate hospital record was available. A skin rash and a positive Kahn test, as well as the history of a stillbirth would indicate a spirochetal infection. In the years following, however, it was not possible to prove, even presumptively, a syphilitic status. The clinical findings of the maxillary lesions were never described as gumma. Results of the Wassermann and Kahn tests were not positive, even early in the course of the nasal infection. Spinal fluid examinations failed to show a positive serology or typical colloidal gold curve. At autopsy there was no evidence of perivascular infiltration in the large vessels and no necrotic tissue from the nose which suggested syphilis. Classification of this case as syphilitic is by association with the disease. It may even have been coincidental.

Other diseases such as Wegener's syndrome must be considered, but the autopsy findings did not support this diagnosis. There was no granuloma in the kidney, lung or larynx. Pathologic examination of the nasal structures showed a progressive, acute polymorphic inflammation. There was not even the granuloma expected in this chronic disease. Periarteritis nodosa was not shown.

In the other case, that of the man with a long history of necrosis of the maxilla, there was no history of syphilis which could be substantiated. Results of the usual serologic and spinal fluid tests were negative. T. pallidum complement fixation tests were non-reactive, but the T.

pallidum immobilization test was "weakly positive." It is tempting to seize upon this positive immobilization test as an explanation, since this is a more recent specific test for syphilis. There are limitations, however, even in this test. It must be emphasized, however, that it should be used more frequently, especially in difficult cases such as those described herein.

In discussing the use of the T. pallidum immobilization test, Thomas [*15*] states, "Data obtained from various sources show that from forty to fifty per cent of patients with positive tests for reagin and negative histories had negative TPI tests. . . . One of the important bits of information obtained by the reported data on the TPI test is that even the so-called experts in syphilis have only about a fifty-fifty chance of making a correct diagnosis of the presence or absence of syphilis in a patient who denies infection, but who has a positive test for reagin. Thus, in the absence of a TPI or other specific test, the physician might as well toss a coin in deciding whether or not a patient with positive tests for reagin has syphilis."

An incidental finding in each of the cases was a lesion in the kidney. In the woman necrotizing papillitis was found. This could be explained as a terminal event or may have been related to the numerous medications which had been used. In the man, acute glomerulonephritis from a kidney biopsy was found. Whether or not these kidney findings are related to the general necrosis problem cannot be stated.

Fungi

Fungous Necrosis. (Case v.) A thirty-nine year old Mexican man was hospitalized because of nasal obstruction and a foul odor from the right side of the nose. Nasal polyps and some necrotic tissue were taken from the nose. A diagnosis of chronic maxillary sinusitis was made, and the patient became asymptomatic after use of antibiotics. He had diabetes controlled by insulin, and had a seropositive serology after treatment. He had once been a laborer in the hold of a banana boat.

Three years later a progressive spreading deformity of the bony parts of the nose was noted. Again a very foul, necrotic mass was found in the right side of the nose. Bone and soft tissue from the middle turbinate area were removed. Sublabial antrotomy was performed and showed, besides necrotic tissue, an absence of the medial wall of the right maxillary sinus. Special microscopic stains showed a fungus. Mycelia and a head resembling aspergillum were found. Double refractory bodies, probably representing monilia, were also reported.

Comment on Fungous Necrosis. Fungous infections of the sinus are not common. Montreuil [*16*] in 1955 stated that seventeen cases have been reported. Monilia forms are not uncommon in diabetic patients. Aspergillus, a fungus of the eumycetes group, may be saprophytic or parasitic. The fumigatus variety usually accounts for the infection.

In one case reported by Montreuil a young woman had a completely opaque right maxillary antrum. An "axle grease" material was found during an antrotomy. The diagnosis in this case was made from pathologic material [*16*]. Unfortunately the material was not studied in the mycology laboratory. A similar omission occurred in case of the Mexican patient just cited.

This case is included as an uncommon sinus and nasal infection. It indicates the necessity for careful differential diagnosis in a patient having a history of syphilis and diabetes. It also emphasizes the need for routing collected material to the proper laboratories.

Undetermined Group

Granuloma Gangraenescens. (Case vi.) A forty-two year old white man, who had been in good health previously, began to complain of left-sided nasal obstruction which gradually became more severe and was associated with crusting and odoriferous discharge from the nose. Physical examination revealed no abnormalities except for slight redness of the left side of the nose and face without pain or tenderness. The left nasal cavity showed necrosis of the septum and medial wall of the maxillary sinus. (Fig. 5.) Blood studies, urinalysis, x-ray examination of the chest, electrocardiograms, serologic tests and sedimentation rate were all within normal limits. Multiple biopsies showed only granulation tissue and inflammatory cells.

For one year after onset of symptoms the course of the disease was steadily downhill, with no ostensible evidence of tumor. A Denker's type exploratory operation was performed to examine the nose, maxilla and ethmoid and nasopharyngeal area. Nothing more was found than on previous procedures—only inflammatory tissue and inflammation. Bacterial studies showed Staph. aureus, Streptococcus faecalis and some contaminants. Tubercle bacilli, Hansen's bacilli or fungi were not found. Muscle biopsy showed no evidence of periarteritis nodosa. Bone marrow was normal.

The patient's initial low grade febrile course increased in intensity in spite of the use of numerous

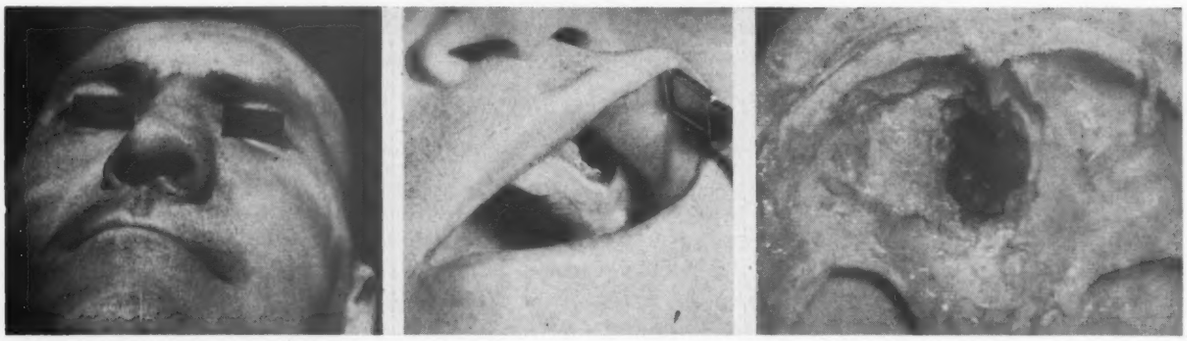

FIG. 5. Case VI. Relentless course of granuloma gangraenescens depicted above. On *left* is seen indurated area near left ala of nose early in course. *Middle* view indicates necrosis of lateral wall of maxilla in oral cavity. To *right* is seen late massive osseous destruction of frontal cranial fossa in area of cribriform plate. Fatal case terminated with frontal lobe abscess and localized meningitis.

antibiotics and chemotherapeutic agents, including streptomycin, Chloromycetin, triple sulfa and Furadantin.® Oxidizing agents were also used to eliminate activity from anaerobic bacteria. Radiation, 600 r, was given without effect. The patient was almost comatose when intravenous steroid therapy (ACTH) was begun. The patient improved dramatically and was maintained on prednisolone. He remained well except for occasional exfoliation of dead bone from the nose and maxilla. Relapse occurred if steroid therapy was interrupted. After being moderately well for about a year, symptoms of fulminating meningitis suddenly developed; he no longer responded to treatment and finally died.

Complete necropsy showed an abscess of the frontal lobe, meningitis and destruction in the cribriform plate. A gastric ulcer and adrenal atrophy were also noted. Microscopic sections from the nasal area showed one small area which suggested possible reticulum cell neoplasm, as evidenced by increased reticulum on special staining. The remaining nasal and maxillary tissue showed only inflammation and granulation tissue. No signs of malignancy were noted in the lymph nodes, respiratory system, pituitary, thyroid, bone marrow, gastrointestinal or genitourinary tracts.

(?) *Neoplasm.* (Case VII.) The patient was a forty-nine year old white man in whom a destructive lesion of the maxilla developed, with erosion and perforation of the palate and necrosis of the septum of the nose. (Fig. 6.) Biopsies taken at an outstanding institution in another state, where the patient had been sent by his family doctor, were interpreted as "very inflammatory, grade four, small cell malignant neoplasm, probably carcinoma."

Treatment with radiation was started, but this was discontinued when the original slides were reviewed in another hospital where he was to have received definitive treatment. A total of 1,200 r had been given.

The patient was given heavy doses of antibiotics and oxidizing agents because of the clinical impression that this might be a serologically negative syphilitic lesion, or a lesion caused by an anaerobic organism. The patient made a dramatic and complete recovery, with a definitive diagnosis of the nature of the inflammatory lesion never having been made.

Comment on Undetermined Group. The literature on granuloma gangraenescens is confusing, primarily because the etiology is unknown and relatively few cases have been completely studied by autopsy. Up to 1949 about forty cases were reported, not all of which were autopsied [*17,18*]. Spear and Walker [*19*] mention only six detailed, autopsied cases in their review of the literature in 1956.

The classic clinical course described by Howells is characterized by nasal obstruction that increases in severity. It is associated with a discharge which is initially watery but later becomes foul-smelling. Ulceration and granulation follow in the nasal cavity and eventually extend to the outer surface of the nose, lids and cheek. The ulceration, frequently painless, is followed by necrosis of the nasal skeleton, sinuses and hard palate [*20,21*].

The histologic picture is that of an inflammatory tissue reaction characterized by proliferation. Histiocytes and reticular cell elements are the main types, although fibroblasts and capillary endothelial cells are found. This proliferation has the appearance of granulation tissue according to Shultberg et al. [*22*].

These authors stated further that several cases showed a lymphoreticular network of the highly cellular process and was further dis-

tinguished by extensive necrotization of the fibrinoid type. In no case was the cell proliferation demonstrably tumorous [22].

Friedman [23] discusses the pathology of this condition, agreeing that the basic microscopic features are those of a non-specific inflammatory process. In addition he believes there are probably two types of malignant granuloma: (1) the classic type with external ulceration of the face with no evidence of polyarteritis on postmortem examination; (2) without external ulceration, destruction spreading beneath the surface; development of ulcers of the palate, tongue, respiratory tract, with widespread necrotizing angiitis and involving other organs which make it similar to Wegener's granulomatosis.

Walker and Spear believe there is no relationship between granuloma gangraenescens and Wegener's granulomatosis, and point out the similarity of the lesions they studied to mycosis fungoides. Howells [24] notes that the association with periarteritis nodosa has been too often repeated to be overlooked.

The treatment of the disease is not satisfactory and almost all cases terminate fatally. Radiotherapy and steroids appear to help temporarily [25]. Antibiotics only support the patient against secondary, superimposed bacterial infection.

The first case of this undetermined group illustrates the characteristics of granuloma gangraenescens, its non-specific acute and chronic inflammation, the extreme destruction of facial tissue and the final fatal outcome. It supports the observation by others that steroids help at least temporarily in this disease.

The resemblance to reticulum cell neoplasia has been noted in other cases besides this one. However, as noted, the line between inflammation and malignancy is not clear. This case did not resemble Wegener's granulomatosis or periarteritis nodosa.

The second case of this group further illustrates the difficulty of diagnosis. This is probably not the only instance when a patient was considered to have a malignant neoplasm which ultimately was considered an inflammatory process.

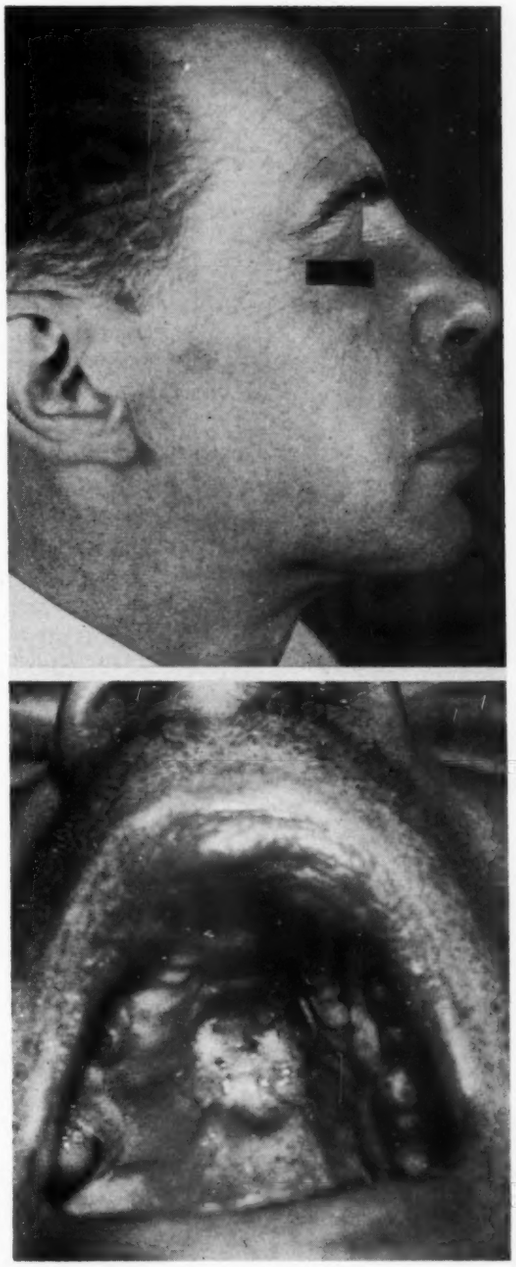

FIG. 6. Case VII. (Courtesy, files of F. L. Lederer, M.D.) Erosion and destruction of the maxilla and palate developed. Microscopic slides were interpreted as "very inflammatory, grade four malignant neoplasm, probably carcinoma." Review of slides failed to show neoplasm. The patient was treated with antibiotics and oxidizing agents, and made dramatic recovery. Note in *top* view the indurated upper lip and nasal columella area. *Below* is seen extensive palatal ulcer which later sequestrated.

SUMMARY

This article attempts to contribute to the literature a discussion of several types of necrosis of the maxilla. Seven cases are described. One of these, metastatic osteomyelitis of the maxilla in an adult, is worthy of mention because of its uncommon occurrence.

Although extensive necrosis of the maxilla

may be fatal, it is not always so; and therefore treatment based upon accurate diagnosis may contribute to cure or control. The diagnostic evaluation must be extended. It includes repeated microscopic study, bacterial culture and sensitivity tests. Tissue culture must also be included, with anaerobic facilities being used.

Surgical aspects of diagnosis and treatment should not be overlooked. Exploratory examination may be indicated, and is not replaced by use of antibiotics. Serologic study is necessary, including history, spinal fluid examination and serologic blood study, such as the specific T. pallidum immobilization test. Biopsy of kidney, skin and lung may be needed. Occasionally electrophoretic studies and tests for amyloid are desirable. A careful selection of laboratory tests and the routing of collected material to the proper laboratory are essential.

Whenever possible a complete necropsy is desirable in a fatal case. Special study not usually included in necropsy material of the facial regions, such as meticulous examination of the arterial system and sinuses, is needed for furthering an understanding of the disease process.

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End of Symposium on Maxillofacial Surgery

Surgery Court Cases

HOWARD NEWCOMB MORSE,* *Chicago, Illinois*

LEONARD VS. WATSONVILLE COMMUNITY HOSPITAL

Supreme Court of California

305 P. 2d 36

This action was taken for damages against three surgeons, a surgical nurse and a hospital. The Superior Court of Santa Cruz County, California, entered a judgment of non-suit as to Surgeon 3, the surgical nurse and the hospital, and the plaintiff appealed. The plaintiff reached an out-of-court settlement with Surgeons 1 and 2. The Supreme Court of California affirmed the judgment of non-suit rendered by the lower court as to Surgeon 3 but reversed the judgment as to the nurse and the hospital.

Surgeon 1, who was in charge of the surgical operation, had scheduled it after deciding that an exploratory examination of the upper right quadrant of the plaintiff's abdomen should be made. The operation began with Surgeons 1 and 2 making an incision from the plaintiff's navel upward. They discovered a "mass" in the sigmoid colon, which appeared to be cancerous. Surgeon 1 consulted Surgeon 3, who agreed that the mass should be removed and offered to help.

In order to speed the operation Surgeon 1 began to close the upper half of the incision while Surgeons 2 and 3 prepared to remove the mass, which was in the lower left quadrant. None of the work of Surgeon 3 was performed in the upper portion of the plaintiff's abdomen, and this surgeon left the room before final closure of the incision. The plaintiff was unconscious during the entire operation, which lasted approximately five hours.

The plaintiff was in considerable pain during the ten days she remained in the hospital following the operation, and the pain persisted for several months after she returned home. X-ray films taken about six months after the operation revealed the presence in the upper right quadrant of the abdomen of a Kelly clamp, an uncurved, scissors-shaped metal instrument about 6 inches long.

During the operation Surgeons 1 and 2 had used about one pack of eighteen Kelly clamps. Surgeon 3 had not used anything but curved clamps. The surgical nurse kept a set of instruments on a tray close to the surgical field. One of her principal functions was to hand instruments to the surgeons and take the instruments back from them. No request for an instrument count was made of the nurse by Surgeon 1. There was testimony to the effect that the practice of hospitals in the area was to maintain a sponge count before closure of an incision and to account for the needles used in suturing, but to make an instrument count only if requested by the surgeon.

The surgical instruments were furnished by the hospital and were placed in sterile packs containing a specified number. After an operation it was the custom for all instruments to be taken directly from the operating room, cleaned and reassembled into packages by a nurse or some other hospital employee. At the time of the plaintiff's operation no one person was designated as being responsible for collecting and reassembling the instruments,

* Counsellor at Law, Member of the Bar of the Supreme Court of the United States of America.

and none of the hospital employees reported that any instrument was missing.

In exonerating Surgeon 3 from liability, the Court declared: "The evidence as to . . . [Surgeon 3's] participation in the operation consisted of the testimony of . . . [Surgeons 1, 2 and 3], and it was clear and uncontradicted to the effect that . . . [Surgeon 3] was not responsible for leaving the clamp in plaintiff's abdomen."

In holding the nurse and the hospital liable, the Court stated: "These defendants seek to avoid liability on the theory that they were required to exercise only that degree of skill employed by other hospitals and nurses in the community . . . General negligence cannot be excused on the ground that others in the same locality practice the same kind of negligence."

COX VS. EPISCOPAL EYE, EAR AND THROAT HOSPITAL

Municipal Court of Appeals for the District of Columbia

134 A. 2d 328

This was a malpractice action based upon the charge of negligence in connection with a surgical operation. The plaintiff was under anesthesia when injured. The Municipal Court for the District of Columbia rendered judgment dismissing the patient's complaint, and the patient appealed. The Municipal Court of Appeals for the District of Columbia reversed the decision of the trial court.

The plaintiff's complaint recited that she was a surgical patient at the defendant-hospital, that she ". . . underwent a surgical operation and, due to the negligence of the defendant, its agents, servants and employees, plaintiff was damaged in and about her mouth . . . and has required and will require medical . . . care for a long time to come." Of this recital in the patient's complaint, the Court declared: ". . . we think the complaint should not have been dismissed. It is true that the complaint did not recite detailed facts constituting negligence. But that is not a strict requirement in a negligence action."

The importance of this decision lies in the fact that in the federal courts a patient in a malpractice case against a surgeon or surgeons alone or in conjunction with a hospital is not required to allege details of surgical negligence in the complaint instituting legal action.

Book Review

Year Book of Cancer, 1956–1957 Series. Edited by Randolph Lee Clark, Jr., M.D. and Russell W. Cumley, PH.D., The University of Texas M. D. Anderson Hospital and Tumor Institute. With the assistance of an editorial board of 119 consulting authorities. Volume 1, 572 pages. The Year Book Publishers, Inc., Chicago. *Price* $7.50.

That this work finally arrives, more than half a century after the first of the series of Year Books appeared, may testify to a significant change in the status of cancer in recent years. The sense of frustration is lifting. A feeling of encouragement is creeping in.

It is because of this spirit that the publishers thought the time ripe for an endeavor to collect into one book all available information on cancer. The organization of this task was entrusted to workers at The University of Texas M. D. Anderson Hospital and Tumor Institute, with Drs. Clark and Cumley serving as chief editors. No simple task has confronted the editors. More than 4,000 articles related to cancer appear in any year throughout the world. In order to tackle the problem of obtaining a significant concentrate of the essential part of such a wealth of publications, the editors created an editorial board of 119 members, each well versed in his particular field. The whole problem of cancer was further divided into twenty-five separate sections, each section having from three to seven editors.

A total of 207 articles is presented. It seems fortunate that in most instances the author has condensed his own article, for the authors have well succeeded in this. In fact, many of the condensed articles present themselves with such clarity and a constructive view that the reviewer was forced back to the original for a comparison and in many cases to added enjoyment.

The editors have fortunately avoided too great concentration. The articles are allotted a total of 560 pages, making an average of two and three-quarter pages for each article.

How well has the field been covered? The editors' aim is to bring together in book form abstracts of significant current articles and contributions related to cancer. The wealth of information brought together in well balanced presentation testifies to a happy dedication to a complicated and complex task. At present only three of the 119 associate editors reside and work outside the United States. As a result the reviewing of the world literature on cancer is not to be claimed. This point is not alarming. Behind this admitted shortcoming hides no chauvinistic or provincial attitude. Rather it is no doubt a question of getting an editorial board of more than 100 men into the field, to learn how it performs, how it is integrated, how it is to be expanded and how its efficiency is to be augmented. This first Year Book seems no dud whatever point of view is adopted.

A book of this kind will of course prove useful to anyone working with cancer as a practicing physician or as a research worker. I think internists and surgeons alike will find food for thought for instance in chapters on metastatic tumors and late care, psychologic aspects of cancer, special surgical problems, chemotherapy, steroids, endocrinology. For the research worker in any one field of cancer the problem is an entirely different one and still in one respect similar. No abstracting, no Year Book will suffice. Reading and re-reading will, of necessity, be extensive and intensive. But here again abstracting to obtain awareness of events in parallel cancer fields presents a genuine problem. In a well known research institute in North America the reviewer had the occasion to study at first hand a highly efficient and complex system of abstracting the pertinent literature referable to the research work at hand and for the private use of the institute. The cost of this service alone runs to about $35,000 per month. With this in mind the cost of this Year Book makes it almost a "give-away."

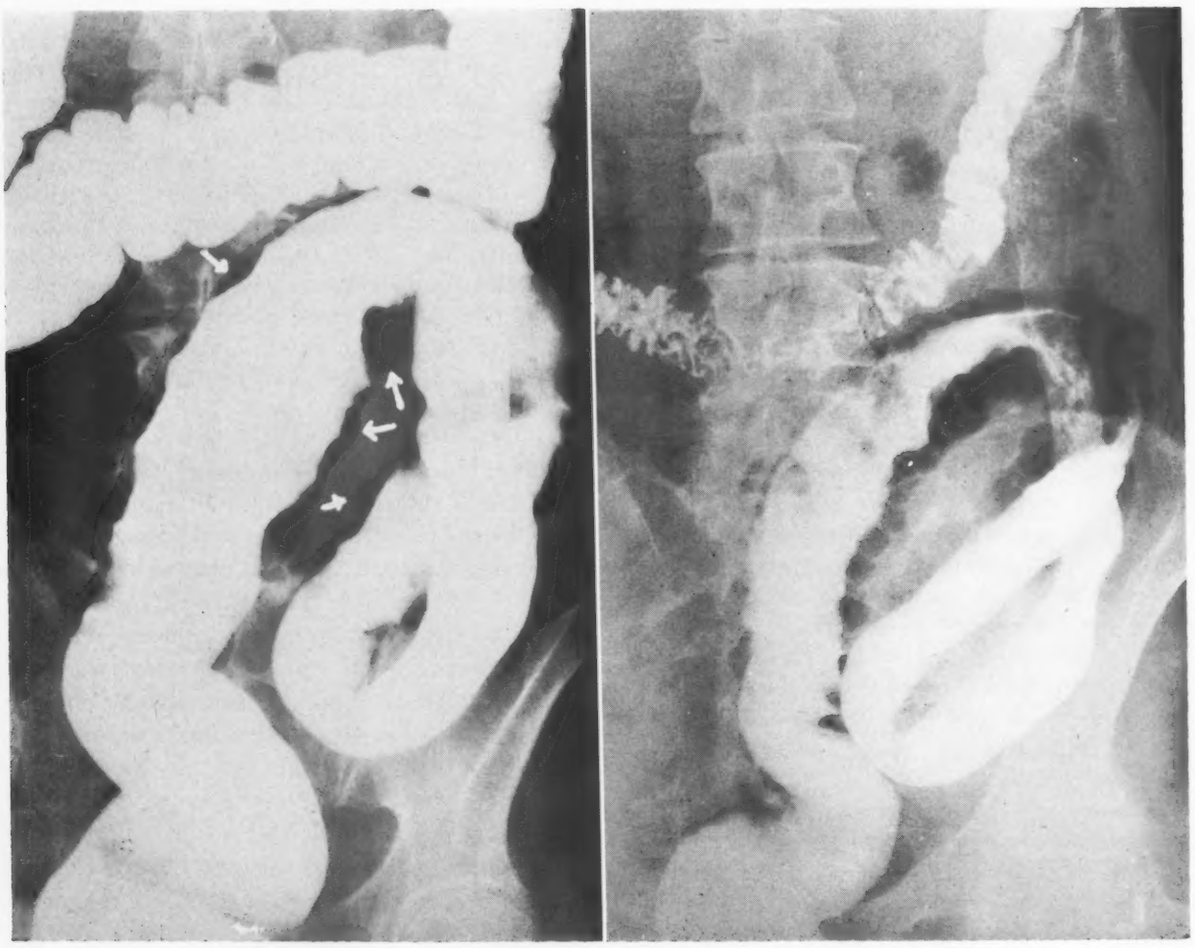
K. K. NYGAARD, M.D.

The Diagnostic Corner

A CLINICAL and radiological teaching exercise concerning an interesting disease of the rectosigmoid colon.

SIDNEY W. NELSON, M.D., *Columbus, Ohio*

From the Department of Radiology, The Ohio State University, Columbus, Ohio.



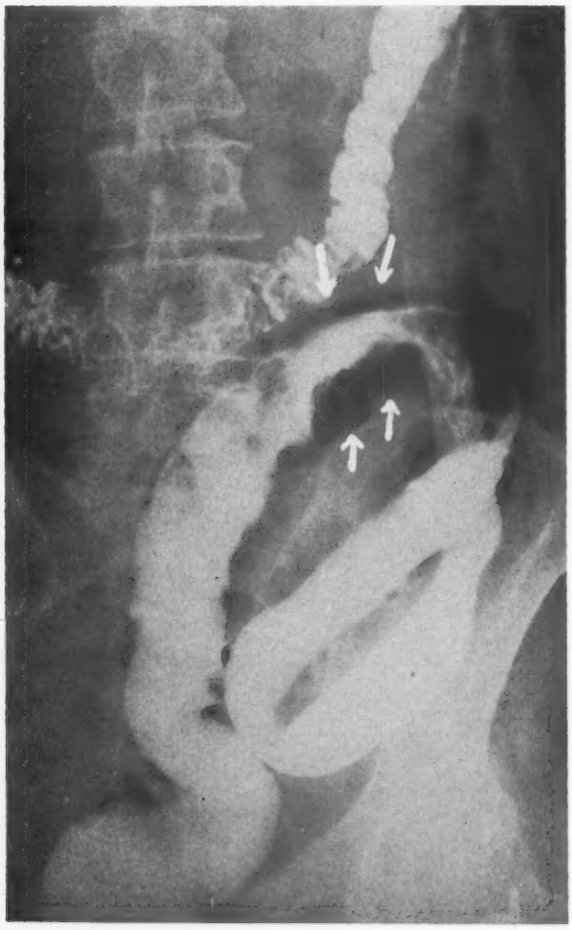
Filled and postevacuation films of rectosigmoid colon (discussed in text).

THE patient was a fifty-six year old white woman who underwent a bilateral lumbar sympathectomy for idiopathic hypertension in 1949. The response to this operation was gratifying, with maintenance of a relatively normotensive state during follow-up visits at six-month intervals. In December, 1955, the patient complained of mucus and small amounts of bright red blood in her stools, which she had noted for the preceding five or six months. There had been no weight loss and her appetite was good. A barium enema examination was normal except for findings limited to the entire rectosigmoid, which was distensible and pliable on fluoroscopic examination, although the entire rectosigmoid colon was irregularly indented (arrows) with radiolucencies which produced a polypoid appearance, which suggested the "pseudopolypoid" changes sometimes seen in ulcerative colitis. These changes are well demonstrated on the foregoing filled and postevacuation films of the rectosigmoid colon. Note that the marginal radiolucent areas not only are outlined on their surfaces in contact with the barium column, but also are sharply contrasted on their outer margins which are not in contact with barium. These films are diagnostic of a pathological process which is frequently misinterpreted. Sigmoidoscopy performed after the barium enema showed peculiar "bullous changes."

What is your diagnosis?

Please turn page for answer

DIAGNOSIS: Pneumatosis cystoides intestinalis.



In this interesting condition innumerable gas-containing cysts of varying sizes are present in the submucosa or subserosa. It is postulated that the intraluminal gas is forced into the bowel wall through ulcers or tears in the mucosa or passes through the mucosa due to increased mucosal permeability due to changes in the pH of the intestinal content. The majority of the reported cases involving the rectosigmoid have followed sigmoidoscopies and biopsies, although in this case there was no previous instrumentation prior to the barium enema. The "bullous changes" at sigmoidoscopy are due to the air cysts which caused the colonic mucosa to project into the lumen.

The x-ray findings are characteristic. Polyps and other lesions of water density can be seen only when surrounded by contrast material, whereas the air cysts are easily contrasted from other water-density tissue, as illustrated on the outer margins (arrows) where the cysts are not outlined by barium but by water-density tissue. The distribution of the confluent strip of gas-containing cysts outlining the barium column in the above figure corresponds exactly to that seen on a preliminary film made before the administration of barium.

Resection of the involved area has been performed in many of the reported cases because of the erroneous diagnosis of carcinoma or multiple polyps. In many of the cases the gas-containing cysts disappear spontaneously. Inasmuch as the majority of the cases are asymptomatic or have minimal symptoms, a conservative approach is probably the best one. This patient has been followed up for three years with no change in symptoms or extent of the disease.

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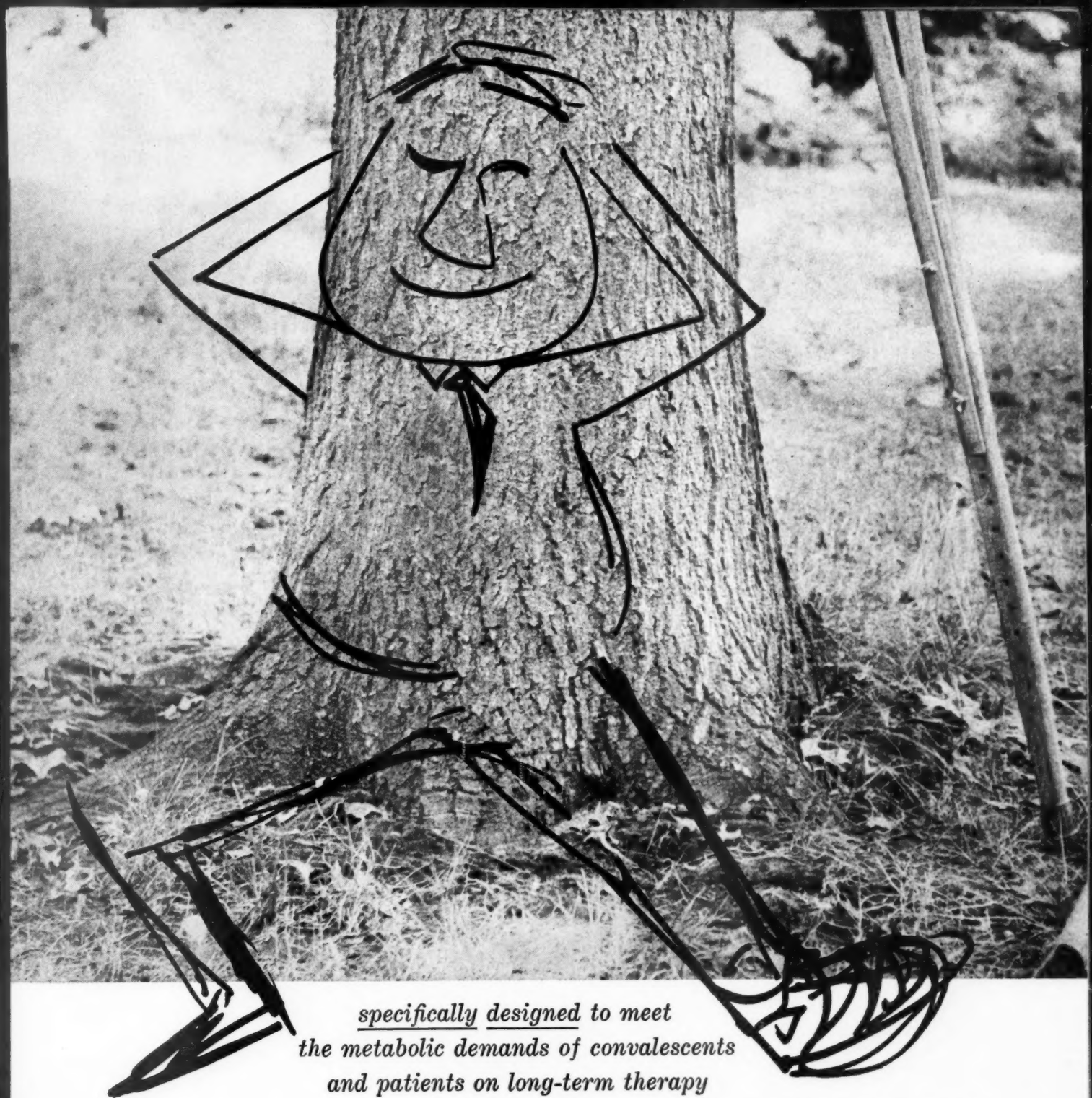

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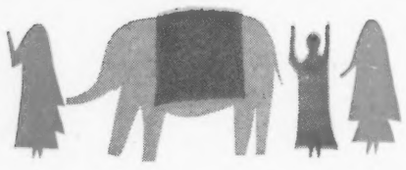

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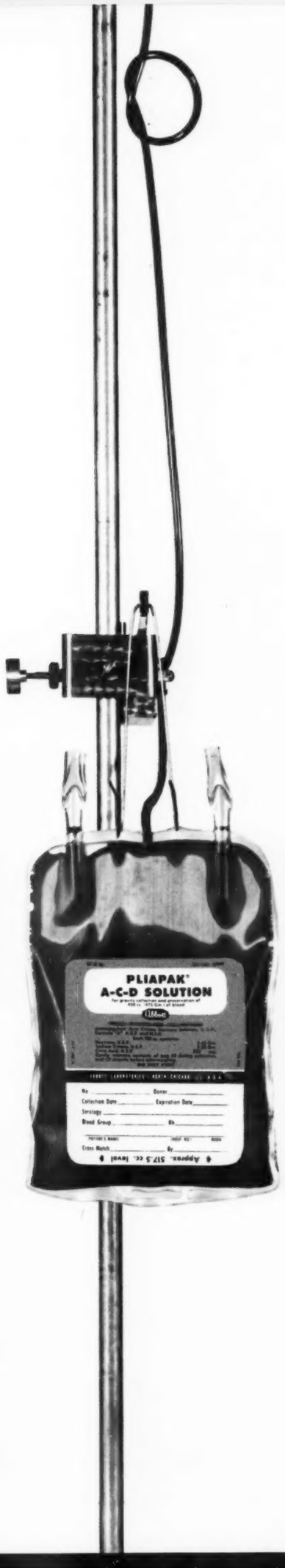

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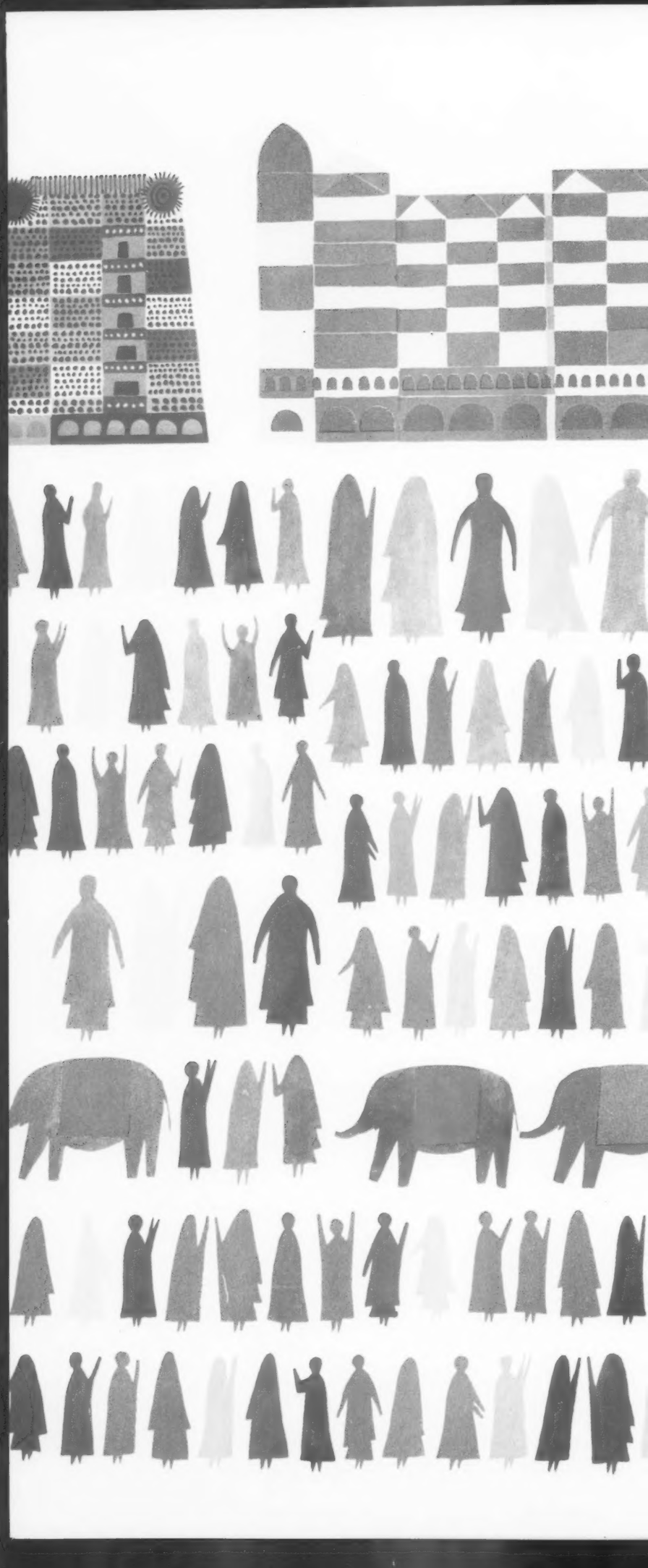

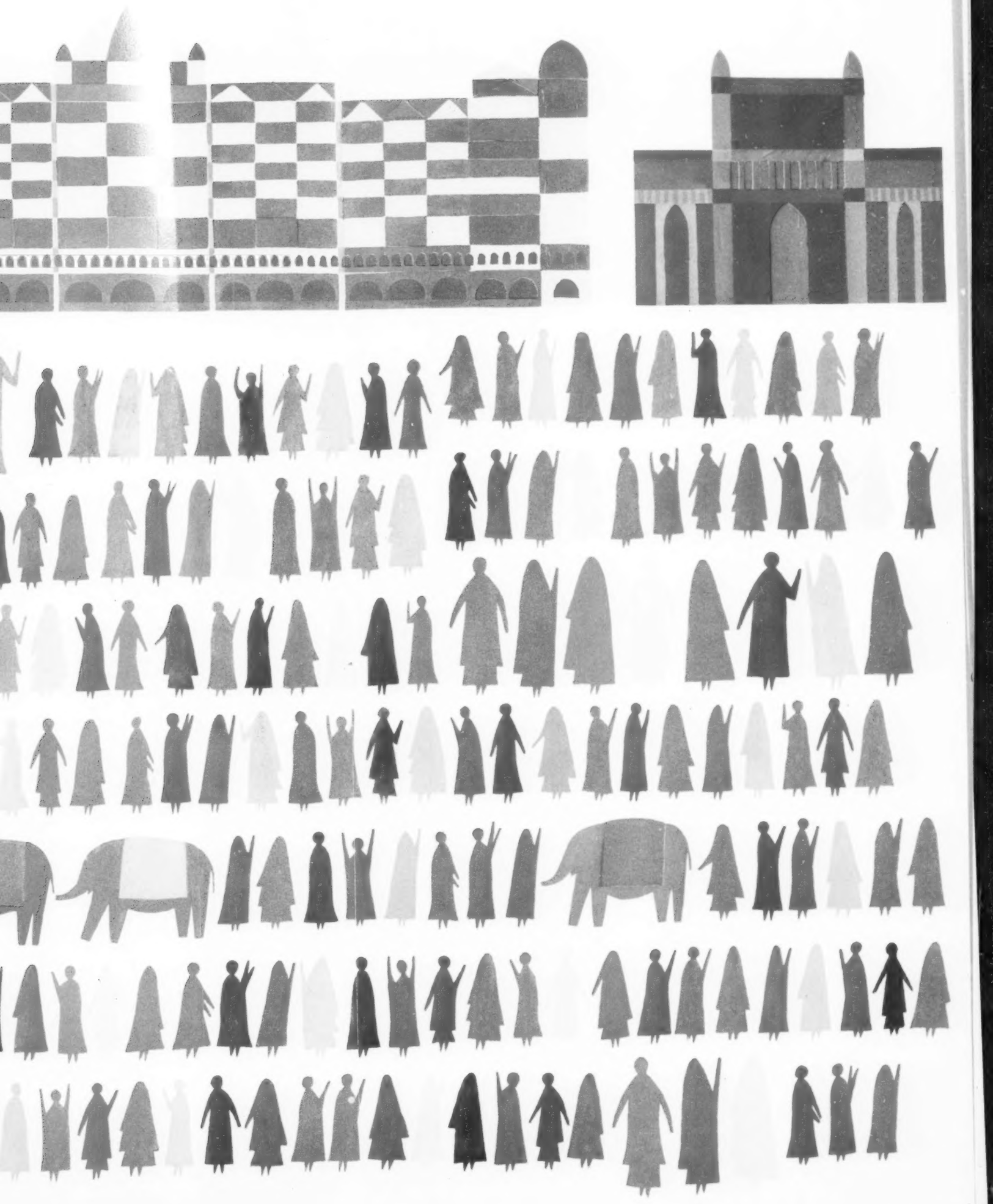

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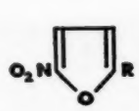

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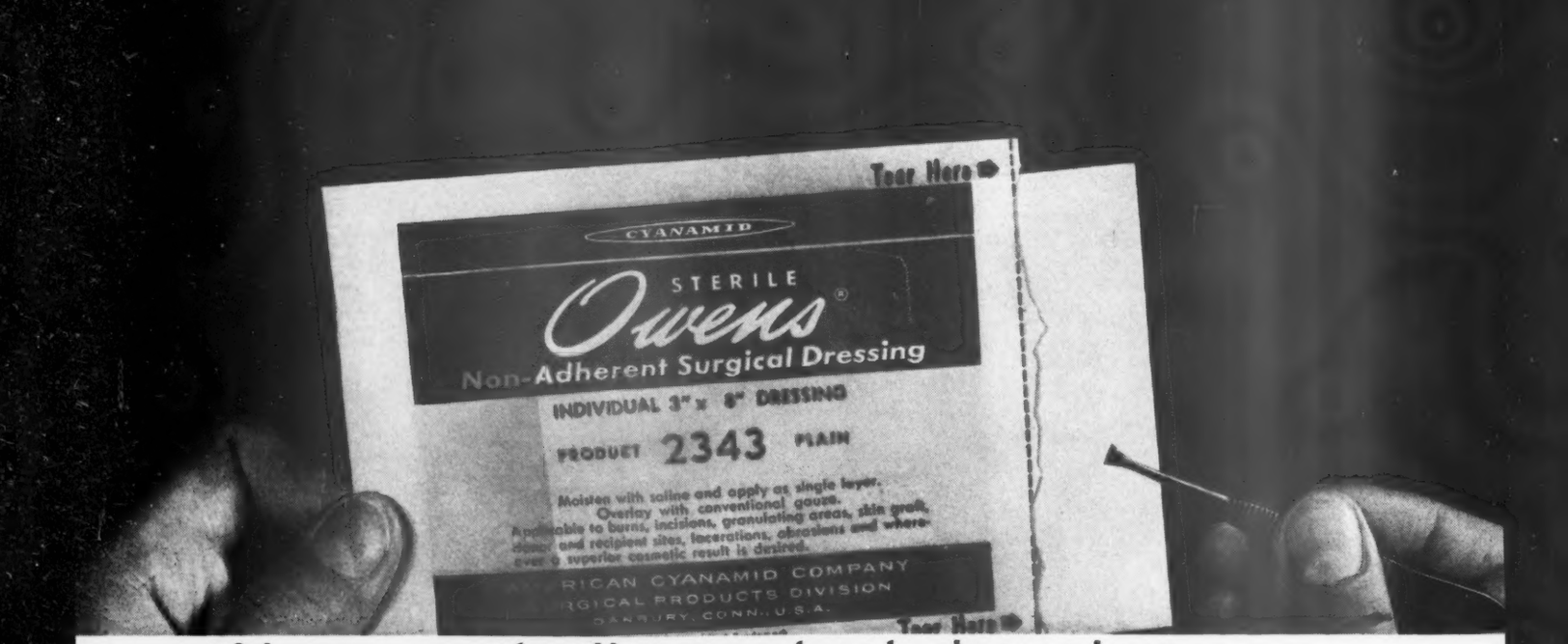
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[1]Thomson, J. E. M.: Am. J. Surgery 91:413 1956

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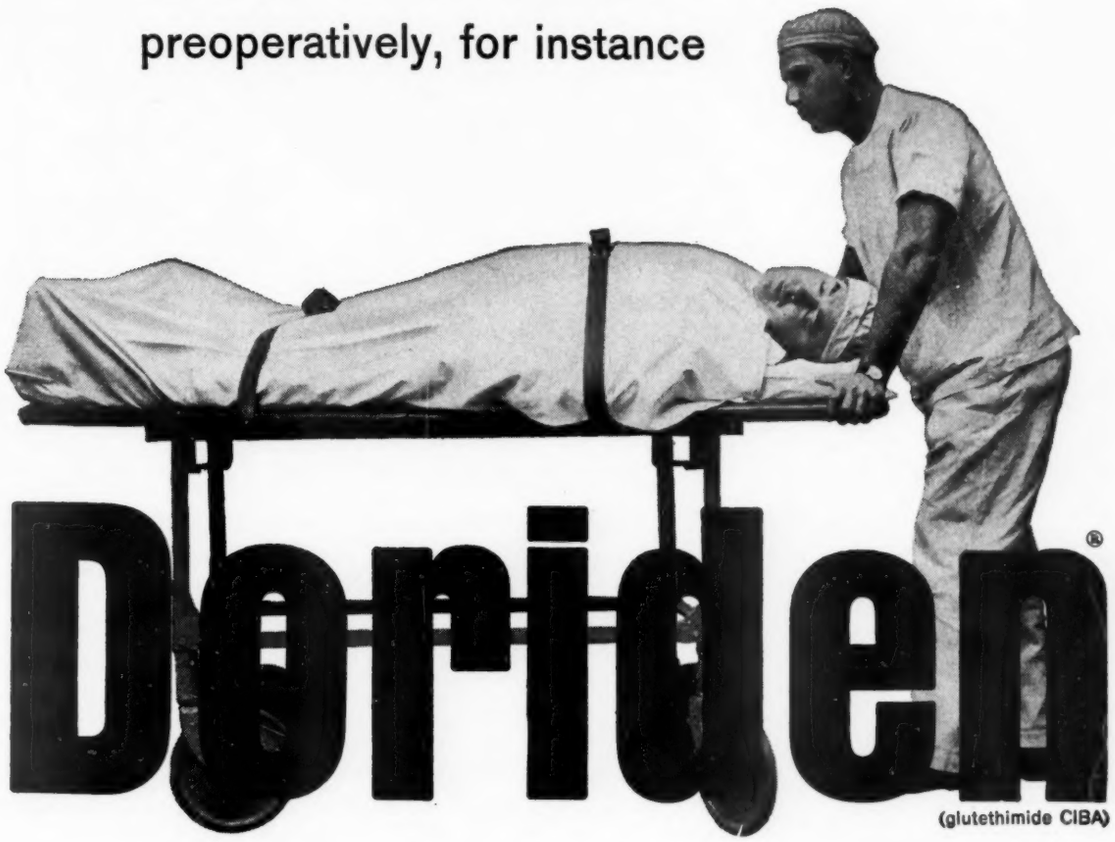

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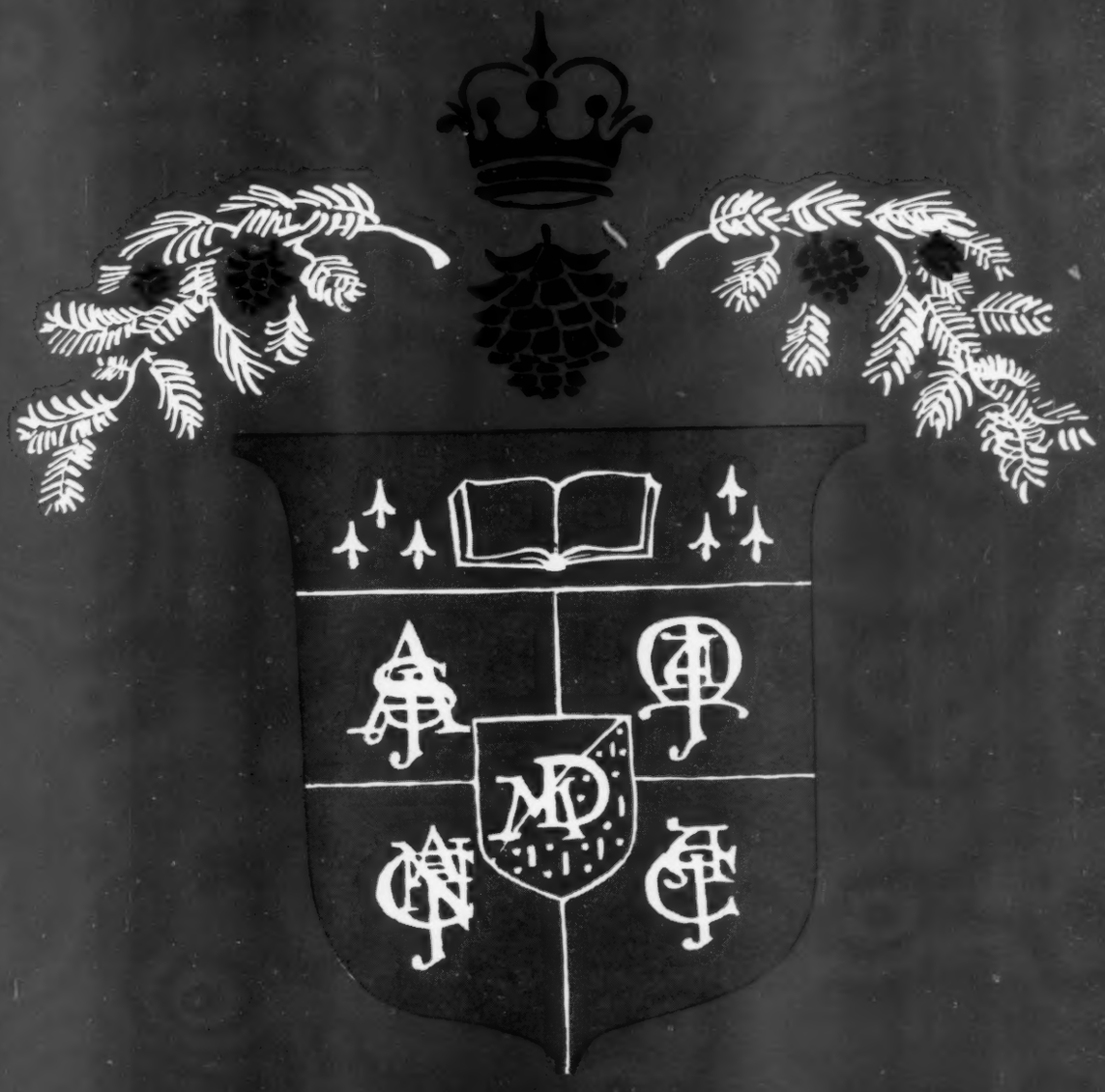

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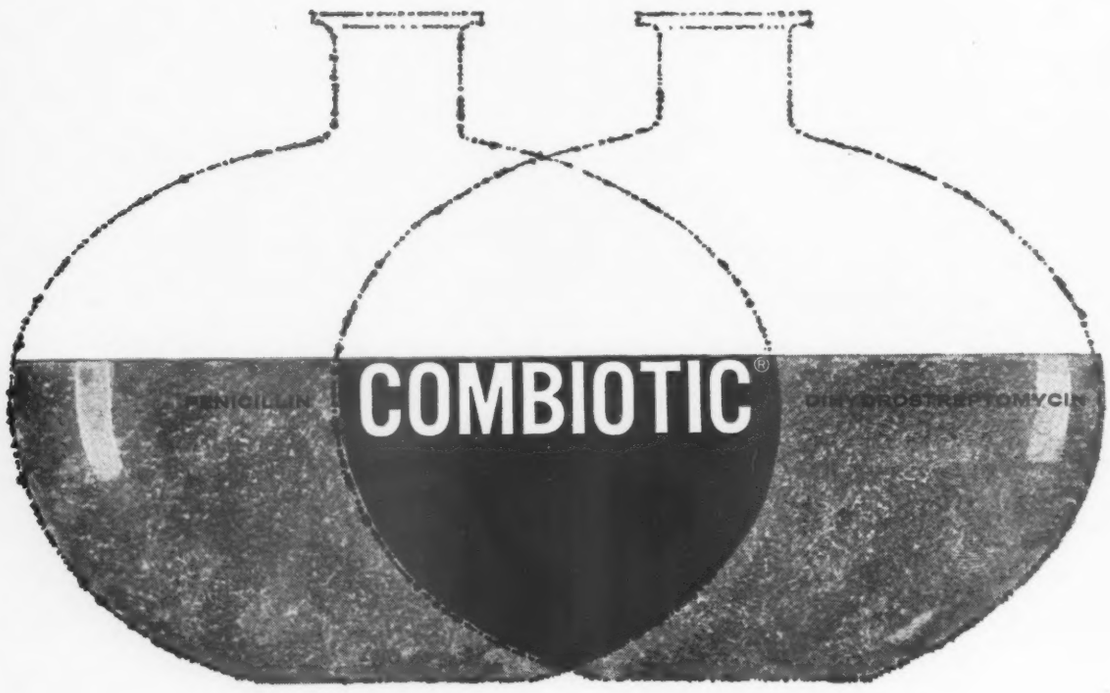

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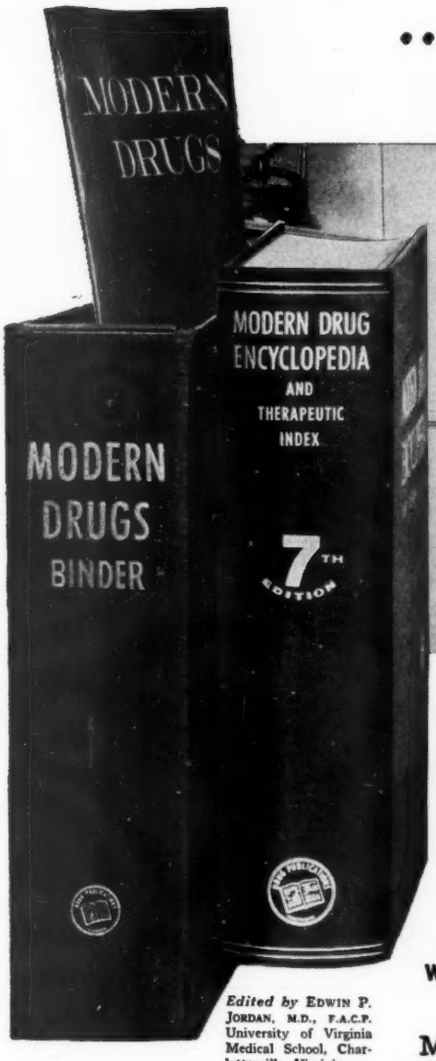

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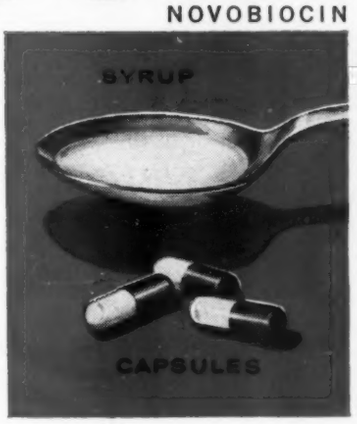

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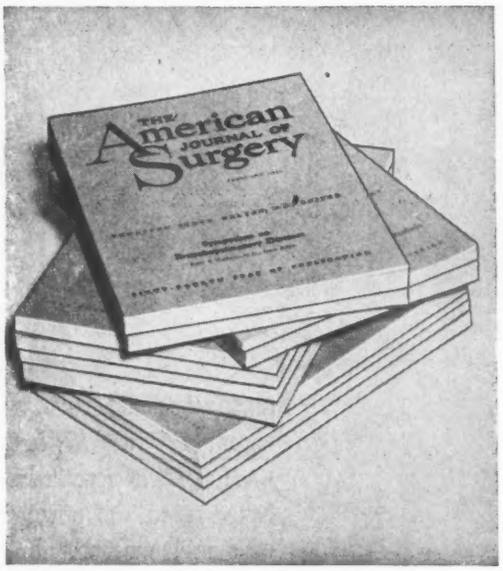

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NOTES AND QUOTES

INFORMATION FOR PATIENTS FACING SURGERY. Advice and reassurance to persons who are facing surgery is provided in a new 25 cent pamphlet, "Your Operation," by Robert M. Cunningham, Jr., editor of *Modern Hospital*, published by the Public Affairs Committee, 22 East 38th Street, New York, New York.

Faced by the necessity of an operation, most patients imagine things that will never happen, Mr. Cunningham declares. "To combat such insecurity, surgical patients need information—facts that most surgeons could tell them in a few minutes.

"Most patients would be reassured, for example, to know specifically that every day 25,000 operations are performed in our hospitals in the United States," the author adds. "Thus, no matter how rare or special it seems to you, your operation is performed hundreds of times daily."

Many of the striking medical advances which have been made in recent years to make operations safer and more successful are described in the pamphlet, including better diagnostic methods, better preparation of patients, and the development of new anesthetic methods. Prospective patients are given a rather detailed picture of what lies ahead so that they will not be upset by unexpected happenings.

A NEW SUCTION APPARATUS. *A self-irrigating suction apparatus for use in gastrointestinal cases has been developed by Hillard Blanck, research fellow in the department of chemical engineering at New York University's College of Engineering. It is to be employed in preoperative and postoperative cases in which the uninterrupted removal of gases and fluids from the stomach and intestines is necessary.*

The need for such an apparatus was dramatically shown to Mr. Blanck when his small son was in the hospital recuperating from peritonitis secondary to a perforated appendix. During the recovery the small tube leading to the stomach frequently became clogged because of the viscous nature of the boy's gastric juices and mucus. A considerable amount of the attending nurse's time and attention was necessary to keep the tube functioning properly. Periodically she would interrupt the suction and flush the tube with water or a saline solution. It occurred to Mr. Blanck that this function might be performed automatically.

After a year of experimentation, and with the cooperation of Dr. Leonard C. Burson, the attending surgeon at the hospital, Mr. Blanck developed a working model. This was tested clinically and a patent was applied for.

Recently the Mark Company of Randolph, Massachusetts, manufacturers of heart and lung equipment for use in heart surgery, became interested in the manufacture of Mr. Blanck's apparatus and exhibited it during the meeting of the American College of Gastroenterology in New Orleans in October.

NEW ORAL VASODILATOR. Relief from painful and often incapacitating conditions resulting from peripheral vascular disease is provided by a new oral vasodilator-spasmolytic drug. The preparation, known as cyclospasmol (cyclandelate), is particularly effective in helping to control manifestations of vasospastic and occlusive peripheral arterial diseases. These include arteriosclerosis obliterans, Buerger's disease and Raynaud's disease.

Cyclospasmol therapy permits patients greatly increased distances of trouble-free walking without the necessity of stopping because of intermittent claudication.

Increased blood flow to the extremities can be observed within thirty minutes after ingestion of 100 to 200 mg. of the drug, and the activity persists from four to six hours. Cyclospasmol promotes healing of leg ulcers and helps prevent gangrene in areas affected by obliterative disease.

Extensive clinical studies in Europe have shown that cyclospasmol is very effective and remarkably well tolerated. Even after doses as high as 1,000 mg. daily no severe side effects have been observed, and there have been no known cases of hypotension following the drug's administration.

This freedom from untoward reactions is attributed to the fact that cyclospasmol acts directly on the smooth muscle of peripheral blood vessels and does not interfere with the sympathetic nervous system.

In clinical research programs in this country, cyclospasmol provided improvement in 77 per

CONTINUED ON PAGE 50

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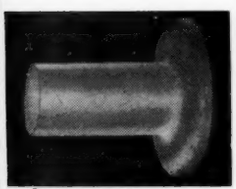

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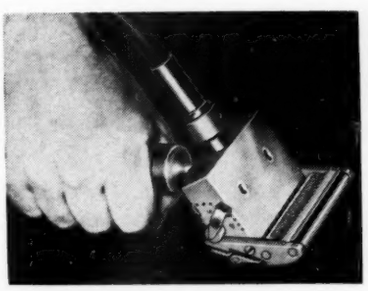

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cent of 132 patients suffering from various peripheral arterial diseases. Another study involving fifty patients at the General Hospital of Mexico City led the investigators, Drs. M. C. Uribe and J. Dominguez, to conclude in *El Medico* that "improvement was brought about by a considerable increase in circulation . . . the spasmolytic action of cyclospasmol was the determinant factor for the patients recovery."

HARMFUL BEDREST. *Definite hazards and disadvantages accompany immobilization or strict bedrest for prolonged periods of time," according to* Therapeutic Notes, *a medical journal for physicians published by Parke, Davis & Company.*

The article, "Bed Rest," states that complete rest for the first two or three weeks of many serious ailments would not seem to be dangerous to the average patient, but rest beyond that time usually results in a loss of general fitness and can cause cardiovascular, respiratory and metabolic disturbances, and tissue atrophy. Such changes are quickly apparent even in healthy young men who are immobilized.

Nineteenth century emphasis on bedrest—"enforced, uninterrupted and prolonged"—secured a lasting place in medical practice, primarily because strict bedrest was highly effective in treating osteomyelitis and bone and joint tuberculosis which were prevalent at that time.

Physicians have found recently that early ambulation for surgical patients, often getting the patient up within the first twenty-four to forty-eight hours after surgery, avoids many of the evils of bedrest, improves morale, and allows them to participate actively in the healing process.

ARALEN BENEFITS RHEUMATOID ARTHRITIS. The antimalarial drug Aralen® provided relief from joint pains for forty-four of seventy ambulatory patients with rheumatoid arthritis during an observation period lasting one to four months, a Finnish physician states in a recent issue of the *Journal of the American Medical Association.*

Dr. J. L. Kalliomaki of the University Hospital in Abo, Finland, administered 500 mg. daily of Aralen in the first week of treatment, followed by 250 mg. daily thereafter. The sedimentation rate improved in forty-three patients, and the hemoglobin level in thirty-four. An evaluation of subjective responses showed that forty-four patients reported the medication relieved joint pains. The series included fifty-four women and sixteen men.

Aralen "seldom provokes troublesome side effects," according to Dr. Kalliomaki, who adds that blood counts are not essential. None of the patients experienced leukopenia, and only two were forced to discontinue treatment due to any reactions.

Referring to Aralen's known benefits in systemic lupus erythematosus, he recommends further trials with the drug in arthritis, since lupus "may be present in patients with rheumatoid arthritis."

NEW SURGICAL LIGHTS. *The Ritter Company of Rochester, New York, has announced a new line of surgical lights. Featured is the twin light for major surgery which, for the first time, mounts self-wiping tracks either flush to the surgery ceiling or concealed as part of the ceiling tiling.*

Of particular interest to the surgeon is his ability to change the size of the light pattern himself (to conform to the actual size of the surgical wound) through the medium of the sterilizable handle which also functions as his means of directing the light beam precisely where he wants it. Provision is also made for the circulating nurse to perform these functions by remote control when so elected.

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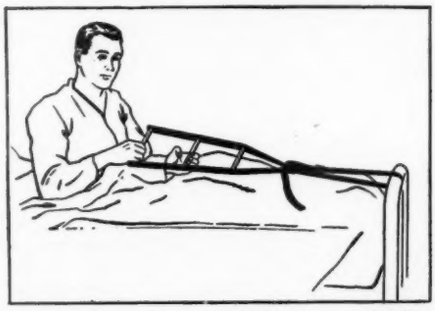

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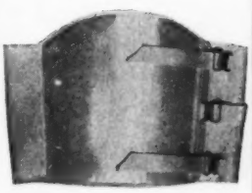

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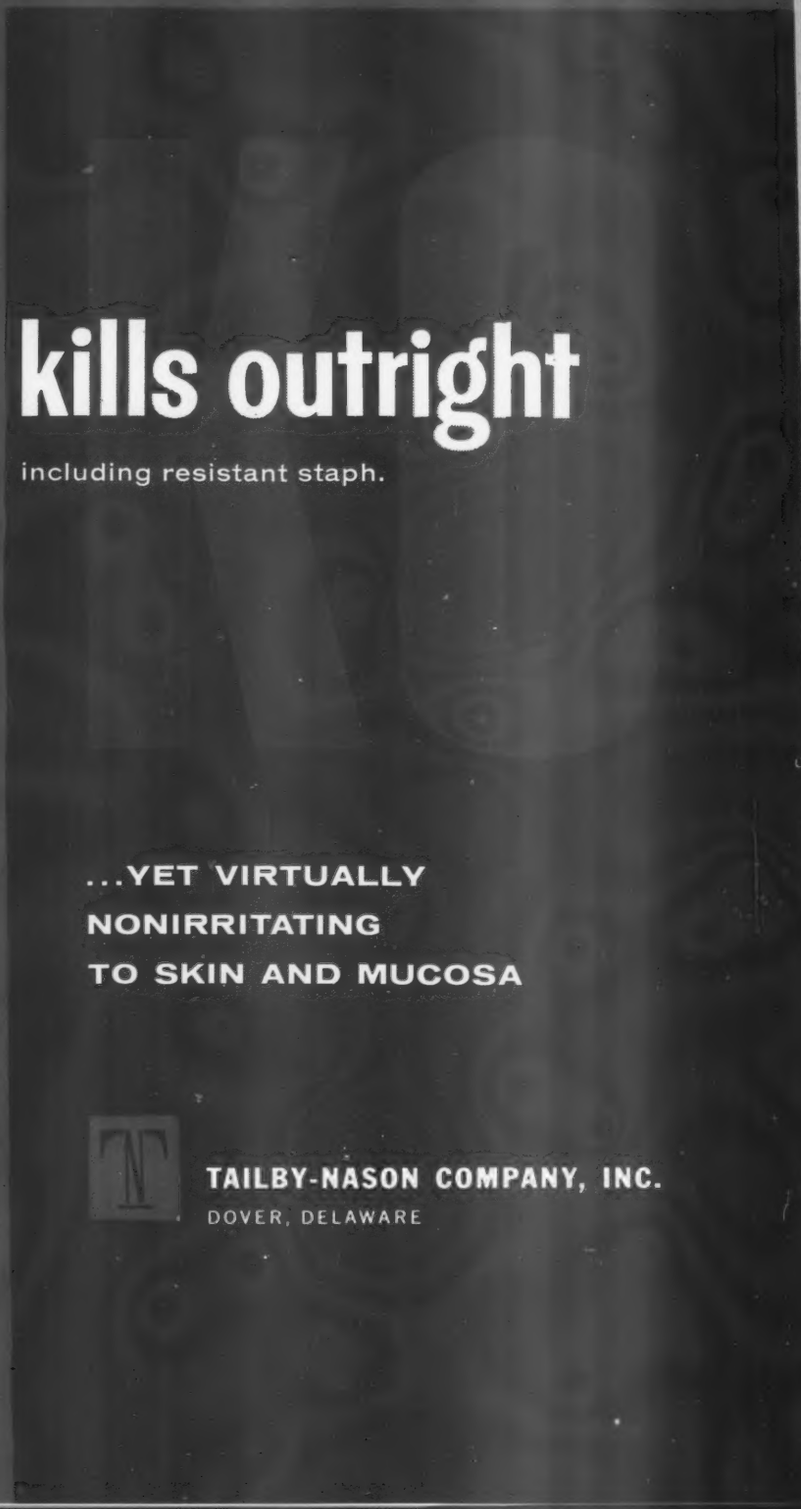

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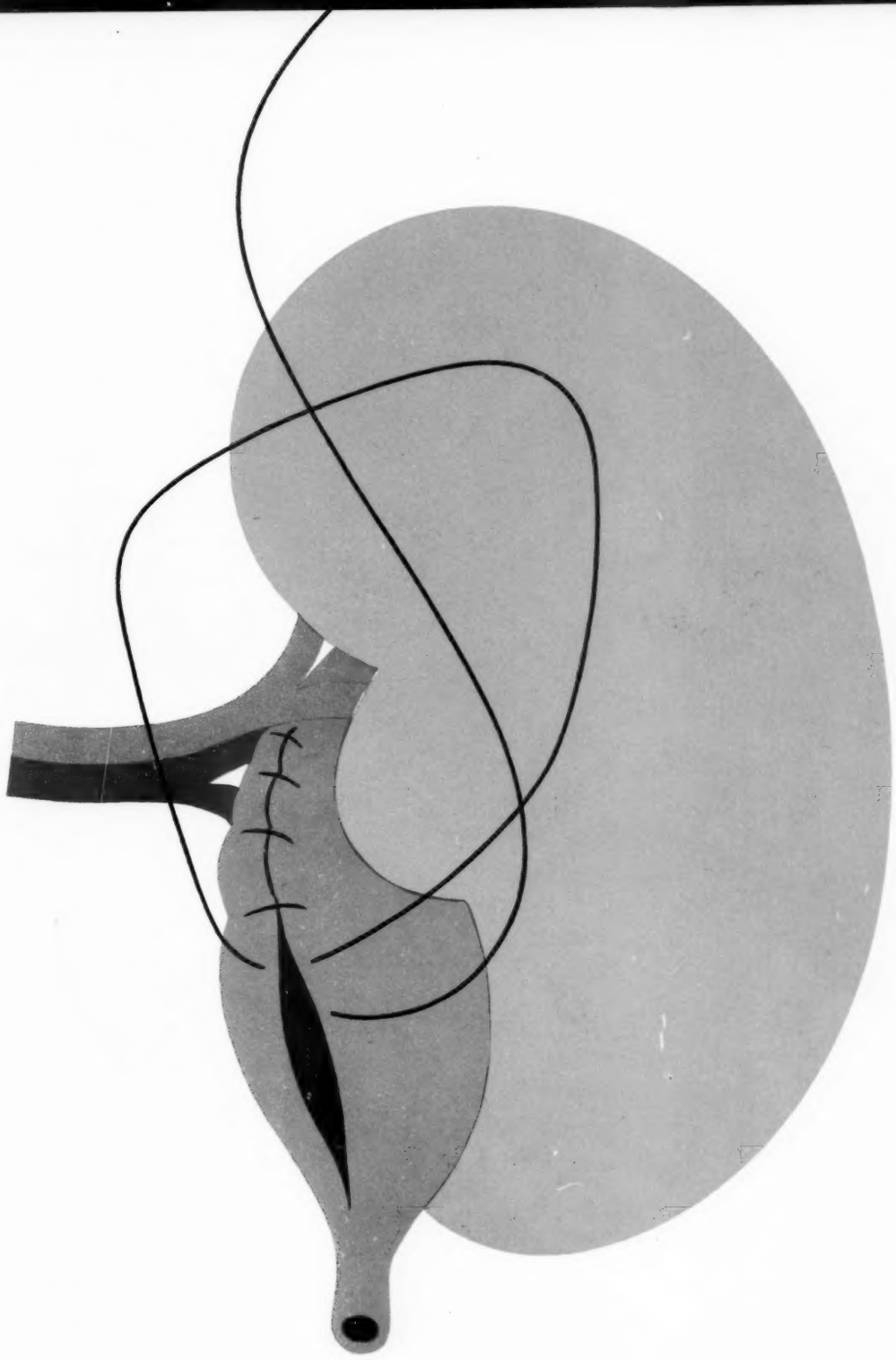

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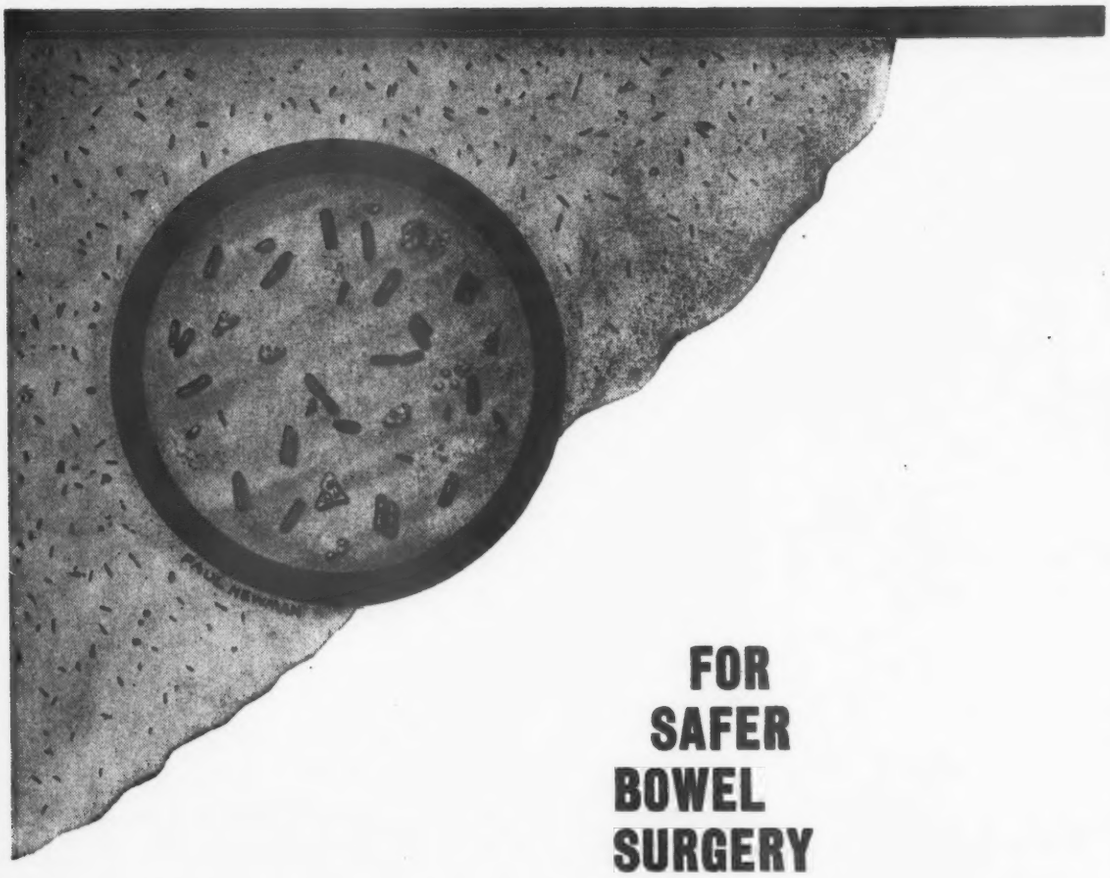

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